

Uitgegeven door het } Rijksherbarium,  
Published by the } Leiden, Nederland.

## THE CONVOLVULACEAE OF MALAYSIA, VI<sup>1)</sup>

by

S. J. VAN OOSTSTROOM

(Rijksherbarium, Leiden)

(Issued 3. IV. 1950).

### The genus *Argyreia* Lour. in the Philippine Islands.

This paper on the Philippine species of *Argyreia* forms an addition to that published by the same author in *Blumea* V, 2, (1943) p. 352—383.

As to the description of the genus, the limitation of it against *Rivea* and the inclusion in it of *Lettsomia* may be referred to what has been said on p. 353—356 of that publication.

In the present paper a key is given to the Philippine representatives of *Argyreia*, followed by descriptions of the species under consideration. Two species, though still imperfectly known, as only fruiting branches are represented in the herbaria, proved to be new ones. By lack of knowledge of their floral characters they could not be inserted in the key. Descriptions of them may be found at the end of this paper.

All species of *Argyreia* occurring in the Philippine Islands are endemic with the exception of *A. nervosa* (Burm. f.) Boj., a species introduced from India, which is found here and there as a garden plant, which did not yet escape from culture, as far as known. *Rivea corymbosa* (L.) Hallier f., from tropical America, in the same way cultivated for ornamental purposes is now spontaneous in some places. As has been stated in *Blumea* V, p. 355 it belongs to the genus *Legendrea* [*L. corymbosa* (L.) Van Ooststr.].

The destruction of the invaluable collections of the Manila herbarium during the war made it necessary to study duplicate-specimens of the types formerly preserved at Manila. The present author is greatly indebted to the directors and curators of the following herbaria for the loan of those duplicates and of other specimens from the Philippine Islands: the herbarium of the "Kon. Plantentuin van Indonesië", Buitenzorg (BZ); the Gray Herbarium, Harvard University, Cambridge, Mass. (GH); the herbarium of the Arnold Arboretum, Jamaica Plain, Mass. (A); the herbarium of the Royal Botanic Gardens, Kew, Surrey (K); the herbarium of the British Museum (Natural History), London (BM); the herbarium

<sup>1)</sup> Part I in *Blumea* III, 1 (1938) p. 62—94; part II in *Blumea* III, 2 (1939) p. 267—371; part III in *Blumea* III, 3 (1940) p. 481—582; part IV in *Blumea* V, 2 (1943) p. 339—411; part V in *Blumea* V, 3 (1945) p. 689—691.



of the New York Botanical Garden, New York, N. Y. (NY); the herbarium of the Botanic Garden, Singapore (SING); the herbarium of the State University, Utrecht (U); the United States National Herbarium, Washington, D. C. (US) and the "Rijksherbarium", Leiden (L).

### Key to the species.

- 1a. Limb of corolla nearly entire or shallowly lobed . . . . . 2
- b. Limb of corolla deeply 5-lobed to 5-parted . . . . . 6
- 2a. Lower surface of leaves densely greyish or whitish sericeous or tomentose. Corolla large, 6—8 cm long . . . . . 3
- b. Lower surface of leaves sparsely hairy or glabrous. Corolla smaller . . . . . 4
- 3a. Leafbase deeply cordate. Nerves 11—16 on each side of midrib. Peduncles long, stout. Bracts large, 3.5—5 cm long, long-acuminate . . . . . 1. *A. nervosa*
- b. Leafbase rounded. Nerves 6—8 on each side of midrib. Peduncles short. Bracts small, at most 0.5 cm long . . . . . 2. *A. nitida*
- 4a. Bracts oblong-lanceolate, 15—20 mm or more long, long persistent. Sepals densely appressed-pilose outside . . . . . 3. *A. sorsogonensis*
- b. Bracts minute, deciduous. Sepals sparsely pilose or glabrous . . . . . 5
- 5a. Peduncle short, 0.5—2 cm. Sepals c. 4 mm long, outer ones with some scattered hairs on their middle portion or glabrous. Filaments pilose at base . . . . . 5. *A. philippinensis*
- b. Peduncle longer, slender. Sepals 6—6.5 mm long, outer ones sparsely appressed-pilose. Filaments glandular-papillose throughout . . . . . 4. *A. pedicellata*
- 6a. Corolla 5-lobed; lobes ovate. Bracts small, lanceolate to narrow-oblong, 3—7 mm long, deciduous. Leaves glabrous or sparsely pilose. Sepals densely appressed-pilose; inner ones with glabrous margins . . . . . 6. *A. luzonensis*
- b. Corolla 5-parted; lobes linear, at the top with 2 glabrous lobules . . . . . 7
- 7a. Sepals glabrous. Bracts minute, glabrous. Leaves ovate or ovate-oblong, glabrous or nearly so . . . . . 9. *A. boholensis*
- b. Sepals densely pilose or tomentose. Bracts larger, pilose. Leaves ovate . . . . . 8
- 8a. Upper surface of leaves and of bracts glabrous. Bracts linear to filiform. Sepals c. 6 mm long . . . . . 8. *A. apoensis*
- b. Leaves and bracts pilose on both surfaces . . . . . 9
- 9a. Bracts lanceolate, acuminate. Sepals 7—8 mm long; outer ones ovate to elliptic, inner ones orbicular. Leaves ovate . . . . . 7. *A. barnesii*
- b. Bracts linear, with a long and linear to filiform acumen. Sepals smaller, c. 5 mm long . . . . . 7a. *A. barnesii* var. *urdanetensis*
- Incompletely known . . . . . *A. paucinervia*, *A. samarensis*

1. *Argyreia nervosa* (Burm. f.) Bojer, Hort. Maurit. (1837) p. 224 (not seen); Merrill, Fl. Manila (1912) p. 386; id., Enum. Philipp. Fl. Pl. III (1923) p. 371; Van Ooststr. in Blumea V, 2, (1943) p. 364 — *Convolvulus nervosus* Burm. f., Fl. Ind. (1768) p. 48, t. 20, fig. 1 — *C. speciosus* L. f., Suppl. (1781) p. 137, excl. patria — *Ipomoea speciosa* Pers., Syn. Pl. I (1805) p. 183 — *Lettsomia speciosa* Roxb., Hort. Bengal (1814) p. 13, nomen — *L. nervosa* Roxb., Fl. Ind., ed. Carey & Wall. II (1824) p. 78 — *Argyreia speciosa* Sweet, Hort. Brit. (1827) p. 289 — *Rivea nervosa* Hallier f. in Bull. Herb. Boiss. V (1897) p. 381.

A large twiner with milky juice. Stems terete, densely and minutely whitish or fulvous tomentose. Leaves petiolate; petiole shorter than or as long as the blade, tomentose like the stem; blade large, ovate to orbicular, with an obtuse to acute or shortly cuspidate, mucronulate apex and a deeply cordate base, 10—30 cm or more long, 8—25 cm or more broad, glabrous or nearly so above, densely fulvous to greyish or white sericeo-tomentose and shining beneath. Nerves 11—16 on each side of the midrib. Flowers in a subcapitate cyme at the end of a stout peduncle; this



peduncle terete, tomentose like the stem, attaining a length of 20 cm or more; pedicels short, angular; bracts large, ovate to oblong or elliptic, with a long and narrow acumen, pilose outside, glabrous inside, 3.5–5 cm long, deciduous. Sepals equal in length or the interior ones a little shorter, densely whitish tomentose outside, glabrous inside, the two exterior ones broad-elliptic, obtuse or acutish, up to 15 mm long, the three interior ones broad-elliptic, to orbicular, obtuse, about 10–12 mm long. Corolla rose-purple, large, c. 6 cm long, tubular to funnel-shaped, constricted at the base into a narrow tube, and with a slightly lobed limb; densely white appressed-sericeo-lanate without, with exception of the connecting fields and the basal part of the corolla. Stamens and style included; filaments pilose at base. Disk annular. Ovary glabrous, 4-celled. Fruit globose, apiculate, c. 2 cm diam., yellowish-brown, nearly dry.

PHILIPPINE ISLANDS: "Planted here and there but not as yet naturalized" (Merrill). Luzon, prov. Rizal, vicinity of Manila, *Cuzner* 4, fl. Nov. 1907.

Distribution: A native of India; cultivated in other tropical countries.

Vernacular name: hoja seda (according to *Merrill*).

2. *Argyreia nitida* (Desr.) Choise in Mém. Soc. Phys. Genève VI (1833) p. 424; id. in DC., Prodr. IX (1845) p. 331; Miq., Fl. Ind. Bat. II (1857) p. 588; Naves in Blanco, Fl. Filip., ed. 3 (1877–83) t. 412; Merrill, Enum. Philipp. Fl. Pl. III (1923) p. 371 — *Convolvulus nitidus* Desr. in Lam., Encycl. III (1791) p. 544 — *Argyreia mollis* auct., non Choisy; Merrill, Fl. Manila (1912) p. 386 — *A. purpuricarpa* Elmer, Leaf. Philipp. Bot. V (1913) p. 1766; Merrill, Enum. Philipp. Fl. Pl. III (1923) p. 372.

A woody twiner with terete, appressed-hairy, glabrescent stems. Leaves petiolate; petiole much shorter than blade, 6–40 mm long; blade oblong, narrow-ovate, ovate or elliptic, with an acute, mucronulate apex and a rounded base, 6–12 cm long, 2.5–9 cm broad, appressed-sericeous on both sides, but much more densely beneath than above and silvery shining. Nerves about 6–8 on each side of midrib. Peduncles axillary, very much shorter than the leaves, 5–10 mm long, densely appressed-pilose, 1–3-flowered; pedicels hairy like the peduncle, much shorter than the sepals, 4–6 mm long; bracts of lateral flowers lanceolate, 3–4 mm long. Sepals unequal in length, the two exterior ones about 12–18 mm long, oblong, acutish or obtusish, with more or less crisped margin, densely appressed-sericeo-tomentose outside, sparsely hairy near the top inside; the third sepal falcate, about 12 mm long, the two interior ones broad-ovate, acuminate, about 9–10 mm long. Corolla pale purple with white throat, large, up to 8 cm long, funnel-shaped to campanulate, with broad, slightly lobed limb and contracted tube; midpetaline bands pilose with long, appressed hairs, basal portion of corolla and connecting fields glabrous. Stamens and style included; filaments pilose at base. Disk annular. Ovary glabrous, 4-celled. Fruit globular, purplish-red, at its base with the patent, enlarged concave sepals, which are purplish red inside. Seeds 4, c. 5 mm long, glabrous, except the pilose hilum.

PHILIPPINE ISLANDS: "In thickets and secondary forests at low and medium altitudes". Luzon, Central Luzon, without exact locality, *Loher* 4170; prov. Nueva Ecija, *Curran*, *For. Bur.* 8420, fr. Jan. 1908; prov. Rizal, *Ramos*, *Bur. Sci.* 36, fl. Nov. 1909;



id., *Ramos, Bur. Sci.* 22002, fl. Oct. 1913; id., Manila, *Merrill, Bur. Sci.* 7352, fl. Dec. 1910; id., San Francisco del Monte, *Loher* 4169, fl. Oct. 1892, and *Loher* 5052, fl. Nov. 1890; id., Jalajala, *Robinson & Ramos, Bur. Sci.* 11920, fl. Oct. 1910; id., Antipolo, *Merrill* 1299, fr. Febr. 1903; prov. Laguna, Mt. Maquiling, *Mabesa, For. Bur.* 27089, fl. Febr. 1918; prov. Tarlac, Concepcion, *Merrill* 3643, fl. Nov. 1903; moreover in Ilocos Norte and Pampanga, according to *Merrill*; Culion, *Merrill* 601, fl. Dec. 1902; Panay, *Vidal* 3354, fr. March 1886; Palawan, Puerto Princesa (Mt. Pulgar), in forests along streams, alt. about 225 m, *Elmer* 12777, type of *Argyreia purpuricarpa* *Elmer*, fr. March 1911 (BZ, L, NY).

**Distribution:** Endemic.

**Vernacular names:** Baging-kastila (Tagalog); bulákan (Panay Bisaya); bulalakan (Panay Bisaya).

A species, closely related to *A. mollis*. Differs chiefly in the form and size of the sepals and in the much shorter and more appressed hairs on the sepals.

*Argyreia purpuricarpa* Elmer, based on fruiting specimens from the island of Palawan, seems to be identic.

**3. *Argyreia sorsogonensis*** (Elmer) Van Ooststr., nov. comb. — *Rivea sorsogonensis* Elmer, *Leafl. Philipp. Bot.* X (1939) p. 3721.

A woody twiner with terete, solid, very sparsely pilose, light to dark brown stems. Leaves petiolate; petiole 3.5–7 cm long, with hairs like those of the stem; blade narrow-ovate to oblong, gradually attenuate towards the acute apex, rounded at the base, 7–15 cm long, 3–6 cm broad, sparsely strigillose or glabrous above, subglabrous beneath or slightly strigillose on the nerves; nerves about 8 on each side of the midrib. Inflorescences axillary, peduncle up to 18 cm long, strigillose; flowers at the end of the peduncle in a few-flowered cyme with long-persistent, oblong-lanceolate, sparsely appressed-pilose bracts, 15–22 mm long; pedicels 2–3 mm long, densely appressed-pilose with greyish hairs. Sepals 7.5–8 mm long, the two outer ones ovate, obtuse or shortly apiculate, densely greyish appressed-pilose outside, glabrous inside; third sepal slightly broader, obtuse, with one glabrous margin; two inner sepals broad-ovate, obtuse, with two glabrous margins. Corolla funnelshaped (only seen in bud); the limb subentire, slightly undulate; midpetaline bands sericeous outside; connecting fields and basal portion of corolla glabrous. Filaments inserted near base of corolla. Ovary conical, glabrous, 2-celled.

**PHILIPPINE ISLANDS:** Luzon, prov. Sorsogon, Irosin (Mt. Bulusan), "in light woods among shrubberies at 1000 feet altitude", *Elmer* 16992, type number, fl. Aug. 1916 (A, BZ, GH, K, NY, U, US).

**Distribution:** Endemic.

**4. *Argyreia pedicellata*** Van Ooststr. in *Blumea* V (1943) p. 379, fig. 2, h–j.

A woody twiner with terete, pale greyish brown, lenticellate stems; the young parts appressed-pilose, soon glabrous. Leaves petiolate; petiole 1.5–5 cm long; blade oblong to ovate-oblong, attenuate towards the obtusish or acute, mucronulate apex, or slightly acuminate, obtuse or acutish at the base, 5–12 cm long, 1.5–6 cm broad, glabrous above except for the midrib, sparsely appressed-pilose and glabrescent beneath; nerves 5–8 on each side of the midrib. Peduncle axillary, 5–10 cm long, sparsely appressed-pilose, lenticellate, cymosely ramified at the top, few- to several-flowered; pedicels sparsely appressed-pilose, more densely so near their



base, 7—12 mm long, in fruit elongate, up to 25 mm long, nodding and slightly curved at the base. Sepals subequal or the outer ones a little shorter; two outer sepals oblong to ovate-oblong, 6—6.5 mm long, sparsely appressed-pilose, third sepal ovate, 6—6.5 mm long, with one thin glabrous margin; two inner sepals broad-ovate to triangular, c. 7 mm long, with two glabrous margins. Corolla white (*Williams*), broadly funnel-shaped, the limb subentire, c. 4.5—5 cm diam.; midpetaline bands sericeous, connecting fields and basal portion glabrous. Filaments inserted near the corolla base, glandular-pubescent, c. 18 mm long; anthers with sagittate base, c. 5 mm long. Style glabrous, filiform, c. 24 mm long. Ovary glabrous, 2-celled. Disk annular, c. 1 mm high. Fruit ellipsoid, up to 12 mm long, with 1 ellipsoid seed.

PHILIPPINE ISLANDS: Luzon, prov. Benguet, Baguio, *Elmer* 5898, fr. March 1904; *id.*, *Elmer* 8439, fr. March 1907 [A, BZ, K, L (*type*), NY, US]; *id.*, *Williams* 1267, fl. July 1904; prov. Abra, Mt. Posuey, *Ramos*, *Sci.* 27021, fr. Febr. 1917.

Distribution: Endemic.

The specimen *Ramos*, *Bur. Sci.* 27021, has the fruiting pedicels and the lower surface of the leaves densely hairy.

*A. pedicellata* has been based by the present author on a fruiting specimen, *Elmer* 8439 in the Leiden Herbarium. Fine flowering specimens, collected by *Williams* (1267) and deposited in the herbarium of the New York Botanical Garden and in the United States National Herbarium are believed to be identic. They have been distributed under the name of *Rivea luzonensis* Hallier f., but are at once distinguishable from that species by the subentire, not deeply lobed corolla limb, the more sparsely pilose sepals and the longer pedicels. In fruiting stage *A. pedicellata* differs from *A. luzonensis* in the much longer pedicels (up to 25 mm, in *A. luzonensis* up to 8 mm, but often shorter) and in the ellipsoid fruit (in *A. luzonensis* globose). Specimens collected by Mrs. *Clemens* in Mindanao, Camp Keithley, Lake Lanao, n. 50, young flowers Sept. 1907 in the United States National Herbarium; *id. s.n.*, fr. March 1906 in the Buitenzorg herbarium and mentioned under this species in *Blumea* l.c., are specifically distinct. The specimens are too imperfect for an accurate description. Another specimen from Mindanao, prov. Lanao, vicinity of Davis Falls, alt. 200—300 m, collected by *Lynn Zwickey* (n. 562), herb. Arnold Arb. with young fruits is probably identic.

5. ***Argyreia philippinensis*** (Merrill) Van Ooststr., nov. comb. — *Lettsomia philippinensis* Merrill in *Philipp. Journ. Sci.* XXVI (1925) p. 488.

A woody twiner with terete, in dry state longitudinally wrinkled, very sparsely appressed-pilose, glabrescent, pale greyish-brown stems. Leaves petiolate; petiole 1.5—6 cm long, very sparsely pilose like the stems and the peduncles; blade ovate to ovate-oblong or narrower, oblong-lanceolate to narrow-lanceolate, acuminate or attenuate towards the acute apex, rounded to truncate at the base or in the narrower leaves acute to cuneate, 7.5—12.5 cm long, (1.5—)4—7 cm broad, glabrous on both sides except for a few scattered hairs, mainly along the nerves and especially beneath; nerves 5—7 on each side of the midrib, secondary veins parallel. Peduncles axillary, short, 0.5—2 cm long, sparsely hairy, cymosely



branched at the top, few-flowered; pedicels sparsely hairy, 2.5—5 mm long; bracts small, triangular, 1—2 mm long. Sepals about equal in length, c. 4 mm long, the two outer ones ovate-elliptic, the interior ones broader, all obtuse, the outer ones with some scattered hairs on the middle portion or entirely glabrous. Corolla white (*Merrill*), about 1.5 (*Merrill*)—2.5 cm long, tubular, the limb very shortly lobed, the midpetaline bands with appressed hairs outside, for the rest glabrous. Filaments (in young flowers) inserted 3 mm above the corolla base, 4 mm long, their dilated base with hairs along the margins; anthers 1.5 mm long. Ovary ovoid, glabrous, 2-celled; style glabrous, about 10 mm long. Fruits ovoid, glabrous, about 12 mm long on pedicels 5—8 mm long.

PHILIPPINE ISLANDS: "In damp forests at low altitudes" (*Merrill*). Luzon, prov. Cagayan, Abulog river, *Ramos, Bur. Sci. 1100*, fr. Febr. 1912; prov. Laguna, San Antonio, *Ramos, Bur. Sci. 10964* (type number), fl. Aug. 1910 (L) and *Ramos, Bur. Sci. 23795*, fr. Oct. 1915; prov. Camarines Sur, Mt. Potianay, *Edaño, Bur. Sci. 75961*, fr. Nov. 1928 (on slopes in forest, 2700 ft); Catanduanes Island, *Ramos, Bur. Sci. 30212*, fr. Nov.—Dec. 1917.

Distribution: Endemic.

Distributed under the name *Rivea luzonensis* [= *Argyreia luzonensis* (Hallier f.) Van Ooststr.] from which the species is at once distinguishable by its short-peduncled cymes and its nearly glabrous or glabrous calyces. Moreover the corolla limb in *A. luzonensis* is distinctly 5-lobed with ovate lobes, whereas in *A. philippinensis* it is nearly entire.

6. ***Argyreia luzonensis*** (Hallier f.) Van Ooststr. in *Blumea* V (1943) p. 379 — *Rivea luzonensis* Hallier f. in *Bull. Herb. Boiss.* VI (1898) p. 714, t. 19 — *R. glabrata* Elmer, *Leafl. Philipp. Bot.* I (1908) p. 334.

A woody twiner with terete, in dry state longitudinally wrinkled, sparsely appressed-pilose, greyish-brown stems. Leaves petioled; petiole 1.5—4(—8) cm, sparsely appressed-pilose; blade broad- to narrow-ovate, or oblong, attenuate or acuminate at the apex, truncate or subcordate at the base, 7—18 cm long, 3.5—13 cm broad, glabrous above or with some scattered hairs, sparsely pilose with appressed hairs beneath; nerves 6—7 on each side of the midrib, finer venation reticulate with subparallel secondary veins. Peduncles axillary, slender, terete or angular, 7—20 cm long, sparsely appressed-pilose, or more densely so towards the apex, cymosely ramified at the apex, with many (rarely few) flowers in an umbellate cyme; pedicels very short, 1—2 mm long, densely appressed-pubescent as are the branches of the peduncle; bracts lanceolate to narrow-oblong, obtuse, 3—7 mm long, densely appressed-pubescent outside, deciduous. Sepals equal in length or the interior ones a little shorter, ovate-oblong, obtuse or sometimes acutish, about 5—6 mm long and 3 mm broad, densely greyish or whitish appressed-pilose outside, the third sepal with one thin glabrous margin, the two inner sepals with two thin glabrous margins; all sepals glabrous inside. Corolla reddish, funnel-shaped, about 2.5—3 cm long, the limb distinctly 5-lobed, c. 4 cm diam., the lobes ovate, the midpetaline bands densely appressed-sericeous, their tips penicillate, the corolla tube and the connecting fields glabrous. Filaments glandular-papillose. Ovary glabrous, 2-celled; disk annular. Fruit purple (*Williams*) or pinkish red (*Foxworthy*), globose, about 1 cm or slightly more in diam.,



the sepals slightly enlarged in fruit, the inner ones with red, glabrous margins; the fruiting pedicels up to 8 mm long, but often shorter. Seed 1, globose.

PHILIPPINE ISLANDS: "Common in thickets and forests, especially along mountain streams at low and medium altitudes, ascending to 1500 m" (Merrill). Luzon, prov. Ilocos Norte, Bangui, *Mc Gregor, Bur. Sci.* 43519, fl. Nov. 1923; prov. Ifugao, *Mc Gregor, Bur. Sci.* 20019, fr. Febr. 1913; prov. Benguet, *Clemens* 17236, fr. Dec. 1926; id., Baguio, near Sablan, *Elmer* 8923, type of *Rivea glabrata* Elmer, fr. March 1907 (A, K, NY, US); id., Baguio, dense jungles along the Bued river gorge, *Elmer* 8482, fr. March 1907; prov. Pangasinan, Labrador, Mt. San Isidro, *Fénix, Bur. Sci.* 29994, fr. Nov. 1917; prov. Zambales, Castillejos, Mt. Canaynayan, *Edaño, Bur. Sci.* 26842, fr. Dec. 1916; id., Mt. Tapolao, *Ramos & Edaño* 44765, fr. Nov.—Dec. 1924; prov. Nueva Ecija, Mt. Umingan, *Ramos & Edaño* 26509, fl. Aug.—Sept. 1910; prov. Bataan, Lamao river, *Barnes, For. Bur.* 60, fl. Oct. 1903 and 351, fr. March 1904; id., Lamao river, Mt. Mariaveles, *Borden, For. Bur.* 2048, fl. Sept.—Dec. 1904 and 2391, fr. Jan. 1905; *Merrill* 3120, fl. Oct. 1903; *Meyer, For. Bur.* 2253, fr. Dec. 1904 and 2417, fr. Jan. 1905; *Whitford* 1035, fr. Jan. 1905; *Williams* 406 bis, fr. Jan. 1904 and 508, fr. Jan. 1904; id., Lamao Forest Reserve, *Foxworthy, Bur. Sci.* 1652, fl. Oct. 1906; id., Dinalupijan, *Merrill* 1540, fr. Jan.—Febr. 1903; prov. Rizal, San Mateo, *Vidal* 1622, fl. Nov. 1884; id. Lucutan, *Loher* 4153, fl. Nov. 1890; id., Montalban, *Loher* 4154; 6593, fl. Aug. 1905; 6682, fl. Oct. 1903; 6685, fr. Jan. 1906; 7288, fr. Dec. 1904; id., Rio Macaharing (Montalban), *Loher* 4152, fr. Febr. 1891; prov. Laguna, *Mabesa, For. Bur.* 24914, fr.; id., Calawang, *Cuming* 692, type number, fl. (K, L); id., Mt. Maquiling, *Foxworthy, Bur. Sci. s.m., Field n. 43*, fr. Nov.—Dec. 1914; id., San Antonio, *Ramos, Bur. Sci.* 23819, fl. Oct. 1915; id., Pililla-Mabita trail, *Robinson & Ramos, Bur. Sci.* 11952, fl. Oct. 1910; prov. Sorsogon, Irosin, Mt. Bulusan, *Elmer* 15431, fr. Dec. 1915.

Distribution: Endemic.

Vernacular name: Busilád (Tagalog); deno(k)dokto (Igorot); sabaltukon (Tagalog); tuid-tuid (Negrito); philippino wire.

Use: The stems are used for tying purposes (*Elmer*).

7. *Argyreia barnesii* (Merrill) Van Ooststr., nov. comb. — *Rivea barnesii* Merrill in *Bur. Govt. Lab. Publ.* 17 (1904) p. 40; id. in *Philipp. Journ. Sci.* I (1906) Suppl. p. 119; id. in *Enum. Philipp.* Fl. Pl. III (1923) p. 371 — *R. cinerea* Elmer, *Leafl. Philipp. Bot.* I (1908) p. 335.

A woody twiner with terete stems; the ultimate parts densely greyish or brownish pubescent to tomentose, the adult parts glabrescent. Leaves petiolate, petiole 2—5 cm long, with a pubescence similar to that of the stem; blade ovate-oblong, ovate or broad-ovate, shortly or long acuminate to caudate and mucronulate at the apex, rounded or cordate at the base, 6—18 cm long, 3.5—13 cm broad, more or less densely and softly pilose to tomentose on both sides. Nerves 7—9(—12) on each side of midrib. Peduncles axillary, 1—many-flowered, pubescent like the stems, 2—14 cm long; pedicels much shorter than or nearly as long as the sepals, elongated in fruit; bracts lanceolate, acuminate, the lower ones of the cyme about 1—2 cm long, pubescent on both sides. Sepals nearly equal in length, 7—7.5 mm long, the two exterior ones ovate to broadly elliptic, obtuse or minutely mucronate, densely pubescent to tomentose outside; third sepal with a glabrous margin at one side, broadly elliptic to orbicular, obtuse or truncate, two interior ones orbicular, emarginate, with 2 glabrous margins; inside of all sepals glabrous. Corolla lavender, 5-parted, the lobes linear, c. 20 mm long and 3—4 mm broad, at the top with two triangular membranous glabrous lobules (connecting fields), outside densely sericeous to the base, the tube c. 9 mm long, glabrous. Filaments c. 15 mm long,



with a large tooth above the base, glabrous. Ovary 2-celled. Fruit purple (*Elmer*), enclosed at base by the slightly enlarged sepals, ellipsoid, up to 1.5(—2, *Elmer*) cm long, 1-seeded; seed ellipsoid, 1 cm long.

PHILIPPINE ISLANDS: "In forests at low and medium altitudes" (*Merrill*). Luzon, prov. Benguet, Baguio, near Sablan, *Elmer* 8882, fr. March 1907, type of *Rivea cinerea* *Elmer* (A, BZ, K, L); and *Fénix*, *Bur. Sci.* 467, fr. Nov. 1910; prov. Pangasinan, Labrador, Mt. San Isidro, *Fénix*, *Bur. Sci.* 29917, ff. Nov. 1917; prov. Bataan, Lamao River, in dry hill forests, 100 m alt., *Barnes*, *For. Bur.* 68, fl. Nov. 1903, type number (BZ, K, NY, SING, US); prov. Rizal, Bosoboso, *Vidal* 840, fr. and young fl. Jan. 1884; and *Ramos*, *Bur. Sci.* 1062, young fl. July 1906; id., Mt. Irig, *Ramos*, *Bur. Sci.* 41952, fr. Febr. 1923; id., Mt. Susong-Dalaga, *Ramos & Edaño*, *Bur. Sci.* 29317, fl. Aug. 1917; id., Orind, *Loher* 5577, fl. Aug. 1905; id., Balabac, *Loher*, *Bur. Sci.* 13050, fr. May 1916; id., Antipolo, Morong, *Merrill* 1657, fr. March 1903; prov. Camarines, Mt. Iriga, *Ramos*, *Bur. Sci.* 22202, fr. Dec. 1913; Mindoro, Paluan, *Ramos*, *Bur. Sci.* 39593, fr. Apr. 1921; Guimaras Island, *Vidal* 3351, fr. March 1885; Samar, according to *Merrill*; Leyte, Dagami, *Wenzel* 472, fl. Sept. 1913; Mindanao, Bukidnon subprov., Tanguilan, *Ramos & Edaño*, *Bur. Sci.* 39036, fl. June, July 1920.

Distribution: Endemic.

Vernacular names: Quahal, guahal (Igorot).

The density of the indument is extremely variable in this species. In the specimens *Ramos & Edaño*, *Bur. Sci.* 29317 and *Ramos*, *Bur. Sci.* 1062 the leaves are densely tomentose on both surfaces; the same is found in *Elmer* 8882, the type of *Rivea cinerea* *Elmer*. The type of *Rivea barnesii* *Merrill*, *Barnes*, *For. Bur.* 68 has the leaves much less densely pilose; still less hairy are the specimens *Fénix*, *Bur. Sci.* 29917 and *Ramos & Edaño*, *Bur. Sci.* 44770. In the last-named specimen the upper leaf surface is glabrous, whereas the lower surface is sparsely pilose, as are the petioles; the stems are nearly glabrous, the young parts being sparsely appressed-pilose; the calyx is also much less pubescent than in the other specimens.

var. *urdanetensis* (*Elmer*) Van Ooststr., nov. var. — *Rivea urdanetensis* *Elmer*, *Leafl. Philipp. Bot.* VII (1915) p. 2605. Characterised by its smaller, 5 mm long sepals and by the corolla lobes being glabrous in their basal portion instead of pilose to the base. Moreover the bracts are narrower than in typical specimens of the species.

PHILIPPINE ISLANDS: Mindanao, prov. Agusan, Cabadbaran (Mt. Urdaneta). *Elmer* 13361 (13351 in the original description), type number, fl. July 1912 (A, BZ, GH, K, L, NY, U, US). A specimen with nearly glabrous leaves and very young flowers, collected in Luzon, prov. Zambales, *Elgincolin*, *For. Bur.* 28662, fl. Aug. 1921 probably also belongs here.

Distribution: Endemic.

Vernacular name: Cawilan, kaulilan (Manobo).

8. *Argyreia apoensis* (*Elmer*) Van Ooststr., nov. comb. — *Rivea apoensis* *Elmer*, *Leafl. Philipp. Bot.* VII (1915) p. 2604; *Merrill* in *Enum. Philipp. Fl. Pl.* III (1923) p. 370.

A woody twiner with sparsely appressed-pilose, glabrescent stems. Leaves petiolate; petiole 2—3 cm long, appressed-pilose; blade ovate, truncate or slightly cordate at the base, acute to acuminate at the apex, 6—10 cm long, 3.5—6 cm broad, glabrous above, appressed-pilose beneath, especially along the nerves. Nerves 6—8 on each side of the midrib. Inflorescences in the axils of the uppermost leaves; peduncle up to 9 cm long, appressed-pilose towards the top with yellowish-grey hairs; flowers in few-flowered umbellate cymes; branches of the cyme and pedicels rather



densely appressed-pilose with yellowish-grey hairs; pedicels 2–4 mm long; bracts linear to filiform, ending in a narrow point, 8–12 mm long, hairy beneath, glabrous above. Sepals nearly equal in length, the two outer ones elliptic-oblong, obtuse, mucronulate, 6.5 mm long, 4–4.5 mm broad, densely appressed-pilose outside; third sepal broader, similarly pilose, with a glabrous margin at one side; fourth and fifth sepal broad-ovate to orbicular, similarly pilose, with two glabrous margins, about 6.5 mm long and 7 mm broad. Corolla, “whitish outside, purplish or violaceous inside” (*Elmer*), 5-parted, the lobes linear, recurved and twisted, c. 24 mm long, 3 mm broad, broadened at the top and there with two glabrous membranaceous wings (connecting fields), the midpetaline bands sericeous outside towards the apex, glabrous inside; the tube glabrous, c. 11 mm long and 4–5 mm diam. Filaments inserted with slightly dilated thick and papillose bases at the mouth of the tube, “10 mm long, anther 3 mm” (*Elmer*). Ovary globose, glabrous, 2-celled. Style “glabrous” (*Elmer*). Disk annular, almost entire, 1 mm high.

PHILIPPINE ISLANDS. “In forests, altitude about 450 m” (*Merrill*). Mindanao, Davao district, Todaya (Mt. Apo), *Elmer 11231*, type number, fl. July 1909 (A, BZ, GH, K, L, NY, US).

Distribution: Endemic.

Vernacular name: Dalumosip (Bagóbo).

Closely related to *A. barnesii* and possibly only a variety of that species.

9. ***Argyreia boholensis*** (*Merrill*) Van Ooststr., nov. comb. — *Lettsomia boholensis* *Merrill* in *Philipp. Journ. Sci.* XXIX (1926) p. 485.

A woody twiner with pale greyish-brown, terete or upwards slightly angular, glabrous stems. Leaves petiolate; petiole 2–3.5 cm long, glabrous; blade ovate or ovate-oblong, rounded or very slightly cordate at the base, acute to shortly acuminate at the apex, 4–10 cm long, 1.5–7 cm broad, thinly coriaceous, in dry state of a greyish or olivaceous colour, glabrous or with a few hairs on the nerves, mainly on the midrib beneath; nerves 8–10 on each side of the midrib. Peduncles in the upper axils, cymosely 1–3(–5)-flowered, 2–7.5 cm long, glabrous or with some hairs; pedicels glabrous, those of the central flower of a cyme about 8–10 mm, of the lateral flowers often shorter; bracts narrow-triangular, with incurved apex, about 2 mm long, glabrous. Sepals glabrous, coriaceous, two outer ones broad-ovate-triangular, obtuse, 5 mm long, third sepal broad-ovate, obtuse, with broad thinner margin at one side, 5 mm long, two inner sepals broader than long, broadly rounded, strongly concave, with two broad thinner margins, about 4 mm long. Corolla with cylindric tube, and deeply divided limb; tube about 8 mm long, glabrous; segments of the limb linear, reflexed and twisted, about 18 mm long, densely sericeous outside, at the top with 2 triangular membranous glabrous lobules (connecting fields). Filaments inserted at the mouth of the corolla tube, geniculate near their thick broadened base, about 11–12 mm long, pubescent. Ovary glabrous, 2-celled, style about 17 mm long. Disk annular, with slightly undulate margin. “Young fruits oblong-ellipsoid, glabrous, about 1 cm long” (*Merrill*).

PHILIPPINE ISLANDS: “In openings in the forest and along streams, altitude 300 to 600 m” (*Merrill*). Bohol, Ramos, *Bur. Sci.* 42772, type number, fl. Aug.—Sept. 1923 (A, BZ, K, US). *Merrill* still mentions another specimen from Bohol, Ramos, *Bur. Sci.* 43247.





Fig. 1. a: *Argyreia paucinervia* Van Ooststr.

b: *Argyreia samarensis* Van Ooststr.

$\pm \frac{1}{2} \times$  nat. size.



**Distribution:** Endemic.

A fruiting specimen with ellipsoid, 12–14 mm long, pink fruits, collected in Luzon, prov. Tayabas, Kinatakutan, Oro, *For. Bur.* 30672, fr. Jan. 1929, in the herbarium of the New York Botanical Garden much resembles this species, but has the sepals appressed-pilose outside.

**10. *Argyreia paucinervia*** Van Ooststr., nov. spec. Fig. 1, a.

Frutex scandens. Ramuli ultimi in sicco longitudinaliter rugosi vel angulosi, pallide fulvi vel cinerei, partibus junioribus appresse pilosis mox glabris, foliis crebris. Folia petiolata, petiolo quam lamina multo breviora, 1–2.5 cm longo, pilis brevibus appressis nonnullis praedito vel glabro; lamina oblonga vel anguste oblonga vel lanceolata, apicem obtusiusculum minute mucronatum versus gradatim attenuata, basi acute attenuata vel cuneata, 10–16 cm longa, 2–4 cm lata, juniora subtus pilis brevibus appressis nonnullis praedita, adultiora glaberrima; nervo mediano nervisque lateralibus angulis acutis ascendentibus utrinque 3–4 supra et subtus planis. Pedunculi (fructiferi) in axillis foliorum superiorum, 2–3 cm longi, pilis brevibus appressis nonnullis praediti, glabrescentes, apice cymoso-ramosi, 3–5-flori, ramis 8–10 mm longis valde divaricatis; bracteae elevatae usque ad basin pedicelli, lineares vel angustissime spathulatae obtusae 20–25 mm longae, c. 3 mm latae sparsim appresse pilosae vel glabrae; pedicelli (fructiferi) pilis brevibus nonnullis praediti vel glabri 2–4 mm longi. Sepala in media parte pilis appressis nonnullis praedita vel glabra, inter se aequilonga c. 6–7 mm longa, exteriora tria ovata apice obtusiuscula, interiora dua late ovata apice obtusa plusminusve emarginata vel irregulariter dentata. Bacca globosa c. 1 cm diam.; semen 1, globosum.

PHILIPPINE ISLANDS: Luzon, prov. Isabella, Mt. Moises, Ramos & Edaña, *Bur. Sci.* 47260, fr. March 1926 (NY, type; BM, US).

**Distribution:** Endemic.

Much resembling narrow-leaved specimens of *A. philippinensis*, but differing in the globular fruits (in *A. philippinensis* ellipsoid), in the long, linear bracts (in *A. philippinensis* minute, triangular) and in the number (3–4) of lateral nerves of the leaves (in *A. philippinensis* 5–7 on each side of the midrib).

**11. *Argyreia samarensis*** Van Ooststr., nov. spec. Fig. 1, b.

Frutex scandens. Ramuli in sicco longitudinaliter rugosi vel angulosi, pallide fulvi, partibus junioribus hirsuti, glabrescentes. Folia sparsa petiolata, petiolo quam lamina multo breviora, 2–5 cm longo, hirsuto; lamina late vel anguste ovata, apice acuta vel paullo acuminata, basi late rotundata (vel subcordata), (5–)9–14 cm longa, (2.5–)4–9 cm lata, utrinque sparse hirsuta, nervo mediano nervisque lateralibus utrinque 8–11 subtus subprominentibus. Pedunculi (fructiferi) in axillis foliorum, 4–10 cm longi, hirsuti, apice cymoso-ramosi, 3–8-flori, ramis pedicellis hirsutis; bracteae deciduae, in speciminibus siccis desunt; pedicelli (fructiferi) 5–10 mm longi, hirsuti, apicem versus incrassati. Sepala dua exteriora elliptica obtusa, 9 mm longa, externe hirsuta interne glabra, sepalum tertium orbiculare apice rotundatum, 8 mm longum, externe margine uno latere excepto hirsutum interne glabrum, sepalum dua interiora orbicularia apice rotundata vel paullo emarginata, 8 mm longa, externe marginibus lateralibus exceptis hirsuta interne glabra. Bacca ellipsoidea vel ovoidea, c. 18 mm longa; semen 1, ellipsoideum, c. 15 mm longum.



PHILIPPINE ISLANDS: Samar, Ramos, *Bur. Sci.* 17489, fr. March—April 1914 (L, type; BM, K, US).

### Excluded species.

*Argyreia malabarica* Choisy, *A. nellygherya* Choisy and *A. populifolia* Choisy, mentioned by Fernandez Villar, *Novissima Appendix* (1880) p. 139, do not occur in the Philippine Islands.

*Rivea corymbosa* (L.) Hallier f. in Engl., *Bot. Jahrb.* XVIII (1894) p. 157; Merrill, *Fl. Manila* (1912) p. 387; id., *Enum. Philipp. Fl. Pl.* III (1923) p. 371, according to Merrill introduced in the Philippine Islands from tropical America; in some places now spontaneous in thickets and secondary forests = **Legendrea corymbosa** (L.) Van Ooststr. in *Blumea* V, 2 (1943) p. 355.

*Rivea leucocarpa* Elmer, *Leafl. Philipp. Bot.* X (1939) p. 3720, based on *Elmer 15766*, Luzon, prov. Sorsogon, Irosin, Mt. Bulusan, fr. Apr. 1916 = **Ehretia** spec. (Boraginaceae).

---



NOMENCLATURAL CHANGES IN SPILANTHES AND BLAINVILLEA  
WITH REMARKS AND A KEY TO THE SPECIES OF SPILANTHES  
IN THE MALAY ARCHIPELAGO

by

JOSÉPHINE TH. KOSTER (Rijksherbarium, Leiden)  
and W. R. PHILIPSON (British Mus. Nat. Hist., London).  
(Issued 3. IV. 1950).

---

There has been considerable confusion over the name *Verbesina pseudo-acmella* and *V. acmella* published by Linnaeus in the *Species Plantarum* (1753, p. 901). He applied these names to definitions taken from his earlier work, *Flora Zeylanica* (1748, p. 144, 145, nos. 308 and 309), with only one unimportant alteration. The title page of the *Flora Zeylanica* shows that the book is intended as an account of Hermann's plants, and this is confirmed for the two species concerned by the close agreement between the descriptions published and the specimens in Hermann's Herbarium preserved in the Department of Botany of the British Museum. These two Linnean species must, therefore, be interpreted by reference to Hermann's specimens, regardless of the fact that figures cited by Linnaeus in the synonymy of each species (viz. Seba, *Thesaur.* 1, t. 10, 11; Plukenet, *Alm.* t. 159, f. 4) are of the plant which generally has been known as *Spilanthus acmella*.

In 1888, Trimen published notes on Hermann's Herbarium (*Journ. Linn. Soc. Lond. (Bot.)* vol. 24, p. 129); he identified the specimens representing these two species as follows: No. 308, *Verbesina pseudo-acmella*, as possibly a young specimen of *Wedelia biflora* DC.; and No. 309, *Verbesina acmella*, as *Blainvillea latifolia* DC. A drawing included in the herbarium he identified as "*Spilanthus acmella*". As this drawing was not mentioned by Linnaeus, it must not be considered when interpreting the species. In his revision of the genus *Spilanthus*, A. H. Moore (*Proc. Amer. Acad. Arts & Sci.* 42, 1907, p. 521) rejected the name *Verbesina pseudo-acmella* L. as referring to a mixture of genera, but retained "*Verbesina acmella* L." as the basis of a species of *Spilanthus*.

One of us (W. R. P.) has re-examined the specimens in Hermann's herbarium and finds that:

*Verbesina pseudo-acmella* L., Fl. Zeyl. 308 (fig. 2) = *Eclipta prostrata* (L.) L. (*E. alba* (L.) Hassk.), not *Wedelia* as suggested by Trimen.

*Verbesina acmella* L., Fl. Zeyl. 309 (fig. 1) = *Blainvillea latifolia* (L.f.) DC. as stated by Trimen.

The drawing, as stated by Moore, is crude and unidentifiable.



It follows that: (I), *Verbesina pseudo-acmella* L. and its several combinations are synonyms of *Eclipta prostrata*, which dates from 1753); (II), the epithet "*acmella*" must be applied to the species at present known



Fig. 1 — Type specimen of *Verbesina acmella* L.



Fig. 2 — Type specimen of *Verbesina pseudo-acmella* L.

as *Blainvillea latifolia*; and, (III), the species known as *Spilanthes acmella* must take the next available name. The necessary nomenclatural changes are set out below.

*Blainvillea acmella* (L.) Philipson, comb. nov. = *Blainvillea latifolia* (L.f.) DC. ex Wight, Contr. Bot. Ind., 1834, p. 17.

*Spilanthes paniculata* Wall. ex DC. Prodr. 5, 1836, p. 625 = *Spilanthes acmella* auct. — non (L.) Murr.

The earlier specific names cited by Moore in the synonymy of *Spilanthes acmella*, namely, *Spilanthes melissaefolia* Salisb. (Prodr., 1796, p. 186) and *Acmella linnaei* Cass. (in Diet. Sci. Nat. 24, 1822, p. 330), cannot be applied to this species as they are mere changes of name for *Verbesina acmella* L. The name *Acmella lanceolata* Link ex Spreng. cannot be



adopted because it was published merely as a synonym of *Spilanthes pseudo-acmella* (L.) Spreng.

*Spilanthes paniculata* Wall. ex DC. appears to be a very variable species. A form with two-coloured heads occurs around Buitenzorg (Java) and was identified by Backer (Handb. Suikerriet-cult. VII, 1934, p. 790) as *Sp. ocimifolia* (Lam.) A. H. Moore. This South American species, however, usually has one-coloured heads with white or whitish-green flowers, according to A. H. Moore (l. c. p. 532). As hardly any other differences are to be found between the plants with two-coloured heads and *Sp. paniculata*, it is proposed here to consider them as a form of that species.

*Spilanthes paniculata* Wall. ex DC. forma **bicolor** Koster.

Capitula bicoloria, floribus disci junioribus purpurascensibus.

J a v a: Buitenzorg; bank of river Tjiliwung, Botanical Garden, *Schiffner* 2777 (Herb. Lugd. Bat.) — type.

Among specimens from the Malay Archipelago many variations are to be seen in the achene of *Sp. paniculata*; they can have (sometime unilateral) ciliated, often pale swollen edges and they are often verrucose with thickened glands, or simply glandular; they are thinly pubescent, especially at the top and most often 2.5 (2—3) mm long; the pappus consists of two, sometimes one or three, often unequal hairs. Study of this species *in vivo* might show that a number of forms are to be distinguished. *Sp. paniculata* occurs all over the Malay Archipelago.

Very closely allied is *Spilanthes calva* DC. which differs by the glabrous or almost glabrous, and somewhat smaller (2 mm long) achenes, without ciliate, swollen edges, and without a pappus. The plants are creeping and rooting at the lower nodes. Although *Sp. paniculata* may have radiate as well as discoid heads, with 0—12 ray-florets, *Sp. calva* never has ray-florets. In the Malay Archipelago, *Sp. calva* is known from Java and the Lesser Sunda Islands.

*Spilanthes iabadicensis* A. H. Moore (l. c. p. 542), fig. 3, is also clearly allied to *Sp. paniculata*. Its heads are smaller and of a different shape. They are radiate, with about five ray-florets, nearly spherical or ovoid (disc 7—11 mm × 5—6 mm) and acute at the top; the involucre is one-seriate; the achene is only 1—1.5 mm long. The leaves are elliptic, rarely ovate-elliptic. The heads of *Sp. paniculata* are also spherical when young (5—6 mm in diameter), but afterwards are conical-ovoid (10—15 mm × 7—9 mm) and obtuse at the top; the involucre is two-seriate; the leaves are broadly ovate or elliptic ovate.

*Sp. iabadicensis* is a common species in Sumatra and Java, but did not receive its name until 1907. Probably this species was meant by Miquel's *Sp. acmella* (Fl. Ind. Bat. 2, 1856, p. 79), though we have not seen a specimen identified by him; it is certainly the case with De Candolle's (Prodr. 5, 1836, p. 623), as well as with Backer's *Sp. acmella* (Backer, l. c. p. 791). All three authors referred to *Sp. paniculata* under the name *Sp. pseudo-acmella*.

### Preliminary key to the species of *Spilanthes* in the Malay Archipelago.

*Spilanthes* Jacq.: heads terminal and in the upper axils, solitary, on long straight peduncles, homogamous or heterogamous, radiate or discoid, becoming ± ovoid; ray-flowers 1-seriate, ♀; disc-flowers numerous, ♂; involucre basin-shaped, involucrel





*Spilanthes iabadicensis* L.  
near pan  
ex. Charles B. Rogers  
Jan 1864  
Tyrone

KEYING CENTER SPILANTHES  
At Alberto H. Moore, 1906.  
*Spilanthes iabadicensis* A. H. Moore  
December 1906

Fig. 3 — Type specimen of *Spilanthes iabadicensis* A. H. Moore.



scales glabrous, mostly with fringed edges; receptacle columnar, tapering to the top, scales navicularly folded around the flowers, with membranous edges; corolla usually yellow, of ray-flowers ligulate, 2–3-lobate at the top, of disc-flowers  $\pm$  tubular, mostly 5-lobate; anthers subacute at the top and entire at the base; branches of the style short, truncate; achene oblong, black, of ray-flowers 3-angular, of disc-flowers flattened from the sides; hairs of pappus short, 2, sometimes 1 or 3 or wanting. Leaves opposite, usually petiolate. Herbs.

1. Heads discoid, large, often two-coloured (yellow and reddish brown), at first 8–12 mm, afterwards 11–18 mm thick, receptacle conical-oblong, obtuse, afterwards 5–6 mm thick; corolla tubular. Leaves triangular or triangular-ovate. Heads on a 6–14 cm long peduncle, at first hemispherical, afterwards cylindrical-ovoid, rounded or obtuse at the top; involueral scales 2-seriate, 15–20, oblong, obtuse, 4–5 mm long; corolla  $\pm$  2 mm long, reddish brown at the top when young; achene ciliate at the edges, for the rest glabrous,  $\pm$  2 mm long; hairs of pappus 2, 1 or wanting. Leaves obtuse at the top, at first suddenly, afterwards gradually, attenuate to the  $\frac{1}{2}$ –4 cm long petiole, dentate, undulate-dentate or nearly entire, nearly glabrous on both sides,  $1\frac{1}{2}$ – $5\frac{1}{2}$  cm long, without petiole 1– $5\frac{1}{2}$  cm wide; perennial;  $\frac{1}{4}$ – $\frac{1}{2}$  m high; from Brazil, in Java sometimes cultivated as a medical plant. . . . . *Sp. oleracea* L.  
 Heads radiate, or when discoid, heads at first 5–6 mm, afterwards 7–9 mm thick, all flowers yellow (except *S. paniculata* Wall. ex DC. f. *bicolor* Koster with two-coloured heads); receptacle subulate or narrowly conical, acute; corolla of disc-flowers funnel-shaped. Leaves ovate, elliptical, lanceolate or linear. . . . . 2
2. Involueral scales 3-seriate, lanceolate, 15–20; receptacle narrowly conical, acute; ligule of ray-flowers oblong, 5–13 mm long, usually long exerted outside the involucre. Heads on 5–18½ cm long peduncles, at first hemispherical, afterwards broadly ovate, obtuse or rounded at the top; disc at first 3–7 mm high, 6–7 mm wide, afterwards 10–17 mm high, 8–12 mm wide; involueral scales obtuse, 3–5 mm long; ray-flowers 5–15; corolla of disc-flowers 2 mm long; achenes with (sometimes unilateral) ciliate, sometimes pale edges, for the rest glabrous or slightly pubescent at the top, 2–2½ mm long (in *Sp. grandiflora* Turcz. var. *calva* Benth. glabrous, without ciliated edges,  $1\frac{1}{2}$ –2 mm long); hairs of the pappus mostly wanting, rarely 2. Leaves ovate-lanceolate or lanceolate, rarely ovate, long attenuate at the top, at first suddenly, afterwards gradually attenuate in a  $\frac{1}{2}$ –2 cm long petiole, undulate-dentate or repandate-dentate, glabrous on both sides, often bullate,  $2\frac{1}{2}$ –8 cm long without petiole, 3–30 mm broad. Often rooting at the lower nodes;  $\frac{1}{4}$ –1 m high; Java, New Guinea; 150–2000 m alt.; way-sides, along ditches, grassy fields, open forests. . . . . *Sp. grandiflora* Turcz.  
 Involueral scales 1- or 2-seriate; receptacle subulate or narrowly conical; ligule of the ray-flowers, if present, oval, 1–4 mm long, slightly exerted outside the involucre. . . . . 3
3. Leaves sessile, oblong-linear or linear; receptacle narrowly conical. Heads discoid, oblong, rounded at the top, on 6–11 cm long, rather thick, ribbed peduncles, which increase to the top, at first  $\pm$  7 mm long and  $\pm$  6 mm wide, afterwards to 11 mm long and  $\pm$  9 mm wide; involueral scales 2-seriate, ovate-oblong, obtuse at the top, 2–4 mm long; corolla  $\pm$  3 mm long; achene obovoid-oblong, with pale thickened edges, 4 mm long; hair of pappus 1,  $1\frac{1}{2}$  mm long. Leaves obtuse at the top, entire, with 3 prominent nerves below, glabrous on both sides, 2–3 cm long, 3–6 mm broad. Creeping, rooting at the nodes and there with ascending branches, lax, elongated;  $\pm$  1 m high; N. Borneo. . . . . *Sp. chamaecaula* A. H. Moore  
 Leaves petiolate or subsessile, ovate or elliptical; receptacle subulate. . . . . 4
4. Heads fairly numerous, often more or less paniculate, with  $\pm$  5 ray-flowers, small, at first subglobose or ovoid, afterwards elongated ovoid, acute, disc at first 3–5 mm high and 3–4 mm wide, afterwards 7–11 mm high and 5–6 mm wide; involueral scales 1-seriate, 5–7; achene 1– $1\frac{1}{2}$  mm long. Leaves elliptical, rarely ovate-elliptical. Heads on 1–12 cm long, mostly filiform peduncles; involueral scales ovate or ovate-lanceolate, obtuse, 2–3½ mm long; receptacle 4–5 mm long; ligule of ray-flowers yolk-yellow, 1–3 mm long; corolla of disc-flowers  $\pm$  1 mm long, 3–5-lobate; achene with (sometimes unilateral, rarely not at all) shortly ciliate, sometimes pale, edges, for the rest glabrous; hairs of pappus 2, sometimes 1, or wanting. Leaves with obtuse or nearly acute tip,



gradually attenuate in a 2—20 mm long petiole, sub-entire or undulate, rarely undulate-dentate, subglabrous on both sides,  $1\frac{1}{2}$ — $8\frac{1}{2}$  cm long without petiole,  $\frac{1}{2}$ —3 cm broad. Mostly creeping at the base, rooting at the lower nodes; annual; 20—80 cm high; Sumatra, Java, New Guinea; 1—1000 m alt.; moist soil, rice-fields, along ditches and rivers, gardens (*Sp. acmella* auct., non (L.) Murr.) . . . . .

*Sp. iabadicensis* A. H. Moore

Heads with or without ray-flowers, at first subglobose, afterwards conical-ovoid, obtuse, at first 5—6 mm long and as wide, afterwards 10—15 mm long and 7—9 mm wide; involueral scales 2-seriate, 8—14; achene 2—3 mm long. Leaves broadly ovate or elliptical-ovate . . . . . 5

5. Heads without or with 5—12 (mostly 5) ray-flowers; achene very variable, with (sometimes unilateral) ciliate, sometimes pale and thickened edges, thinly and shortly pubescent especially at the top, often warty by thickened glands, 2—3 (mostly  $2\frac{1}{2}$ ) mm long; hairs of pappus 2, sometimes 1 or 3, often unequal in length. Sometimes rooting at the lower part of the stem and the lower branches. Heads (two-coloured in *Sp. paniculata* Wall. ex DC. f. *bicolor* Koster) on a  $2\frac{1}{2}$ —16 cm long peduncle; involueral scales ovate, oblong or elliptical, obtuse or subacute,  $2\frac{1}{2}$ — $3\frac{1}{2}$  mm long; receptacle finally 5—10 mm long; ligule of ray-flowers sulphur-yellow, 1— $1\frac{1}{2}$  mm, rarely to 4 mm long, subglobose or broadly oval; corolla of disc-flowers (with purplish tips when young in *Sp. paniculata* Wall. ex DC. f. *bicolor*)  $\pm$  2 mm long, 4—5-lobate. Leaves acute or obtuse at the tip, at first suddenly, afterwards gradually attenuate in a 3—45 mm long petiole, entire, undulate, undulate-serrate or repandate-serrate, often bullose, on both sides glabrous or nearly glabrous, 1—12 cm long without petiole,  $\frac{1}{2}$ —7 cm broad; annual; 10—80 cm high; Sumatra, Java, Lesser Sunda Islands, Borneo, Celebes, Moluccas, New Guinea (f. *bicolor*: Java, Buitenzorg); 1—2000 m alt.; moist grassy and other fields, rice-fields, banks of rivers, way-sides, edges of forests (*Sp. acmella* auct., non (L.) Murr., *Sp. pseudo-acmella* auct., non (L.) Murr., *Sp. rhombifolia* Zp.) . . . . . *Sp. paniculata* Wall. ex DC.
- Heads without ray-flowers; achenes glabrous or subglabrous, without ciliate edges,  $\pm$  2 mm long; pappus wanting. Creeping and rooting at the nodes. Heads on a 3—13 cm long, thin or fairly thin peduncle; involueral scales broadly ovate or oblong, with obtuse or acute tips, 3—4 mm long; receptacle finally 4—7 mm long; corolla of disc-flowers 1—2 mm long, 4—5-lobate. Leaves obtuse at the top, at first suddenly, afterwards gradually attenuate in a 1—10 mm long petiole, undulate or undulate-serrate, sometimes entire, thinly pubescent on both sides, 1— $4\frac{1}{2}$  cm long without petiole, 6—25 mm broad; annual; 30—80 cm high; Java, Lesser Sunda Islands; 1—2000 m alt.; moist soil, grassy fields, monsoon-forests (*Sp. rugosa* Bl.) . . . . . *Sp. calva* DC.

PLANTS COLLECTED BY TH. HERZOG ON HIS SECOND  
BOLIVIAN JOURNEY, 1910—1911

Part IX

LABIATAE

identified by

C. EPLING (Los Angeles)

(listed by J. Th. Koster, Rijksherbarium, Leiden).

(Issued 3. IV. 1950).

Teucrium L.

**Teucrium vesicarium** Mill.; Epling, Syn. S. Amer. Lab. in Fedde, Repert., Beih. 85 (1935—1937) 3.

Hab.: im Wald um Santa Cruz, 450 m alt., Jan. 1911, n. 1334.

Lepechinia Willd.

**Lepechinia bella** Epling l. c. 21.

Hab.: zwischen Steinen auf dem Kamm des "Meson" bei Samaipata, 2100 m alt., März 1911, Bl. tiefviolett, n. 1762; auf Grashängen des Cerro Sipascoya, 3500 m alt., April 1911, Bl. blau, n. 2051.

**Lepechinia graveolens** (Regel) Epling l. c. 25.

Hab.: häufiger Strauch im subalpinen Gebüsch bei Pojes, 2300—2600 m alt., April 1911, Bl. weiss, Kelch reif lila, n. 2059.

**Lepechinia heteromorpha** (Briq.) Epling l. c. 26.

Hab.: Strauch an der Waldgrenze über Tablas, 3400 m alt., Mai 1911, Bl. weisslich, n. 2140.

Salvia L.

Seccio Calosphace Benth.

Subsectio Tomentellae Epling

**Salvia retinervia** Briq.: Epling l. c. 57.

Hab.: Charakterstrauch an trockenen, felsigen Abhängen im Caipipendithal, 1000 m alt., Dez. 1910, Bl. tiefblau, n. 1219.

Subsectio Angulatae Epling

**Salvia amplifrons** Briq.; Epling l. c. 71.

Hab.: im Nebelwald des Bergkammes bei Comarapa, 2600 m alt., April 1911, Bl. weiss und lila, n. 1948; ?, im Bergwald bei Tres Cruces, 1450 m alt., Febr. 1911, Bl. weiss, n. 1593.



Subsectio *Privoideae* Epling***Salvia sophrona* Briq.; Epling l. c. 81.**

Hab.: auf Wiesen des Gipfels über Vallegrande, 2550 m alt., März 1911, Bl. tiefblau, n. 1846.

***Salvia tiraquensis* Briq.; Epling l. c. 82.**

Hab.: im Wald am Fuss der Sierra de Caipipendi, 1000 m alt., Dez. 1910, Bl. hellblau mit weiss, n. 1224; ?, Alpenwiesen des Sunchalkammes, 2900 m alt., April 1911, Bl. blau, n. 2005/e.

***Salvia stachydifolia* Benth.; Epling l. c. 82.**

Hab.: im Gebüsch an der Cuesta de Duraznillos, 2800 m alt., April 1911, n. 2027.

Subsectio *Chariantha* Epling***Salvia orbignaei* Benth.; Epling l. c. 107.**

Hab.: an trockenen Berghängen bei Comarapa, 2200 m alt., April 1911, Bl. rosa, n. 1917.

Subsectio *Cylindriflora* Epling***Salvia praeclara* Epling, l. c. 121.**

Hab.: im Gebüsch des Comarapathales, circa 2000 m alt., April 1911, Bl. feuerrot, n. 1877.

***Salvia haenkei* Benth.; Epling l. c. 123.**

Hab.: kleiner Strauch an sonnigen Abhängen über Araca, 3500 m alt., Oktober 1911, n. 2334.

***Minthostachys* Griseb.*****Minthostachys andina* (Britt.) Epling l. c. 166.**

Hab.: kleiner Strauch mit Pfefferminzgeruch im subalpinen Buschgürtel bei Comarapa, 2300 m alt., April 1911, Bl. weiss, n. 1901.

***Scutellaria* L.**Sectio *Heteranthesia* Benth.Subsectio *Uliginosae* Epling***Scutellaria breviflora* Benth.; Epling l. c. 174.**

Hab.: an Buschrändern hinter Camatindi, 700 m alt., Dez. 1910, n. 1155.

Sectio *Perilomia* (Kunth) Epling***Scutellaria ocymoides* (Kunth) Epling l. c. 178.**

Hab.: an steinigen Abhängen zwischen Sunchal und Pojos, 2200 m alt., April 1911, Bl. feuerrot, n. 2008.

***Eriope* Kunth**Sectio *Platanthera* EplingSubsectio *Crassipedes* (Briq.) Epling***Eriope crassipes* Benth.; Epling l. c. 192.**

Hab.: auf Bergtriften der Cuesta de los Monos, 1400 m alt., März 1911, Bl. lila, n. 1700.

**Hyptis** Jacq.Sectio *Buddleioides* Benth.Subsectio *Umbellatae* Epling**Hyptis tafallae** Benth.; Epling l. c. 221.

Hab.: Strauch an Abhängen der Felschlucht unterhalb Socotal, 1600 m alt., Juni 1911, Bl. helllila, n. 2245.

Sectio *Mesosphaeria* Benth.Subsectio *Spicaria* (Benth.) Epling**Hyptis spicigera** Lam.; Epling l. c. 244.

Hab.: in Santa Cruz aus Samen gezogen; stammt von den Hügelfeldern der Provinz Velasco, 300 m alt., Sept. 1908, blühte April 1911, leg. B. Burela, n. 2205.

Subsectio *Eriocephalae* Epling**Hyptis eriocephala** Benth.; Epling l. c. 248.

Hab.: in der Felsheide bei Teneria, 3000 m alt., Nov. 1911, n. 2467.

**Hyptis kuntzeana** Briq.; Epling l. c. 248.

Hab.: im Gebüsch am Berg über Vallegrande, 2500 m alt., März 1911, Bl. lila, n. 1793.

Sectio *Polydesmia* Benth.Subsectio *Vulgares* Benth.**Hyptis mutabilis** Briq.; Epling l. c. 259.

Hab.: auf Bergwiesen bei Samaipata, 1950 m alt., März 1911, Bl. lila, n. 1785.

Sectio *Myriocephala* Benth.**Hyptis odorata** Benth.; Epling l. c. 263.

Hab.: Strauch in der Buschregion von Tres Cruces (Cord. de Santa Cruz), 1500 m alt., Febr. 1911, Bl. weiss mit violetten Streifen, n. 1589.

Sectio *Xylodontes* (Benth.) EplingSubsectio *Axillares* (Benth.) Epling**Hyptis hirsuta** Kunth; Epling l. c. 297.

Hab.: in den Hügelfeldern westlich des Rio Pirai, 500 m alt., Jan. 1911, Bl. weiss, n. 1340.

Sectio *Cephalohyptis* Benth.Subsectio *Marrubiastrae* Benth.**Hyptis lappacea** Benth.; Epling l. c. 310.

Hab.: an feuchten Stellen eines Potrero bei Santa Cruz, 450 m alt., Jan. 1911, n. 1373.



## NOTES ON THE FLORA OF JAVA, V.

### IDENTIFICATION OF THE NEW SPECIES AND COMBINATIONS PROPOSED BY C. P. THUNBERG IN THE FLORULA JAVANICA BY L. WINBERG AND F. O. WIDMARK (1825)

by

C. A. BACKER, R. C. BAKHUIZEN VAN DEN BRINK Jr  
and C. G. G. J. VAN STEENIS.

---

Though the new names published in Thunberg's "Florula" have been entered in the Index Kewensis, few botanists have tried to verify the status and synonymy of the new species proposed in this 2-thesis booklet. Thunberg's names were entered in Juel's "Plantae Thunbergianae" (1918, 412 pp.).

The diagnoses are generally too short and vague to allow a definite opinion. Only Schott, Mueller Arg., and F. E. Wimmer have examined material of resp. the Araceae, Euphorbiaceae, Campanulaceae.

The booklet contains descriptions of 41 species. Of these 21 were proposed as new and were no homonyms. The type specimens of these new species which are, in general, well-preserved and complete were put at our disposal by the kind co-operation of Dr H. Nannfeldt, Director of the University Institute for Systematic Botany at Uppsala. The assistant-botanist Dr Carl G. Alm informed us that 2 species could not be unearthed, and also were not mentioned in Thunberg's catalogue, written 1820, viz: **Cyperus uniflorus** Thunb. and **Passerina javanica** Thunb.

It appears that nearly all species could be very easily identified: of the 21 new species 2 could not be examined, 5 had been reduced earlier, 13 are reduced in this paper, and 1 is a doubtful name (*Pandanus*). In 3 other cases Thunberg's epithets proved to be the correct ones under the Rules. Accordingly 3 new combinations have been proposed. A few species, which were not collected in Java, presented some difficulties as appeared from the notes on the back of the sheets written by Bergius: *Pandanus odoratus* Thunb. was a native of Mauritius, and *Vitis trifoliata* Thunb. of Surinam, whilst others hailed from Ceylon. One additional species earlier described by Thunberg is included in our report, viz. *Bignonia javanica* Thunb., nomen.

One plant-geographical remark may precede the alphabetically arranged list of the identification: though the bulk of Thunberg's plants were collected in the lowland of Java, apparently in the environs of Batavia, two plants of his Javan collection have undoubtedly been collected at at least 800 m altitude, viz. *Anotis hirsuta* and *Pratia nummularia*. These have been collected either S. of Batavia or S. of Semarang.

The species alphabetically listed below are preceded by the number they bear in the Florula Javanica. At the end of the reference the locality where they were collected is cited in accordance with Bergius's notes on the sheets.

43. *Acrostichum lineare* Thunb. Fl. Jav. (1825) 23. — Java.

This is reduced to *Stenochlaena palustris* (Burm. f.) Bedd. Cf. Backer & Posthumus, Varenflora v. Java (1939) 150.

25. *Arum purpureum* Thunb. Fl. Jav. (1825) 20. — Java.

According to Engl. Pfl. R. IV, 23, F (1920) 97 dubious, but as Schott noted rightly on the type specimen, identical with *Homalomena rubescens* (Roxb.) Kunth. As Roxburgh's basynym dates from 1832, this species, which is not rare near Batavia must be called *Homalomena purpurea* (Thunb.) B. B. S., comb. nov. It is not, as is asserted in Ind. Kew. a species from Japan.

34. *Clerodendron spicatum* Thunb. Fl. Jav. (1825) 22. — Ceylon.

According to Lam & Bakhuizen van den Brink, Bull. J. B. B. III, 3 (1921) 78 possibly synonymous, with *Clerodendron serratum*. The specimen undoubtedly represents a well-known Javan drug of the genus *Orthosiphon*, commonly known as *Orthosiphon stamineus* Bth. in Wall. (1831). This is antedated by the name *O. aristatus* (Bl. 1826) Miq. [*O. grandiflorus* (Bl.) Bold.]. A still older epithet is used in *Orthosiphon spiralis* (Lour.) Merr., Lingnan Agr. Rev. 2 (1925) 137, but it seems that the type specimen of Loureiro's is missing (as was affirmed by Dr G. Taylor, May 1949) or has, at any rate, not been properly identified, and that, therefore, its interpretation is liable to doubt. Thus, the correct name for this plant seems to be *Orthosiphon spicatus* (Thunb.) B. B. S., comb. nov. Why this very common drug was not botanically described earlier than 1825 is not quite understandable.

*Bignonia javanica* Thunb. Mus. Ups. xvii (1794) 150; Fl. Ceyl. 1825, 7, nomen; Juel, p. 321. — Java.

This plant of which the vernacular name was given as "kudo" is present in 3 sheets with an immature pod and 3 leaves. It represents *Dolichandrone spathacea* (L. f.) K. Sch. Why this species, which was collected in Java, was mentioned in the Florula Ceylanica and not in the Florula Javanica is not clear.

39. *Croton spiciflorum* Thunb. Fl. Jav. (1825) 23.

Apparently based on *Caturus spiciflorus* Burm. According to Mueller Arg. there were 2 specimens representing *Claoxylon indicum* (Reinw. ex Bl.) Endl. ex Hassk. According to Corner this species should not be called *Cl. polot* (Burm. f.) Merr. (cf. Gard. Bull. S. S. 10, p. 292).

37. *Croton orbiculare* Thunb. Fl. Jav. (1825) 23. — Java.

This is clearly identical with the species currently known as *Mallo-tus moluccanus* M. A. Merrill has shown (Enum. Philip. Fl. Pl. 2, 1923, 432) that the basynym derived from *Croton moluccanus* L. cannot be used, as Linné's type specimens represent two other *Euphorbiaceae*.



This plant should be called **Melanolepis multiglandulosa** (Bl. 1825) Rehb. f. & Zoll. As neither the exact month of publication of Thunberg's *Florula* nor the exact month of publication of Blume's 12th "Bijdragen" is known we have to provisionally accept them to be simultaneously published in the year 1825. As Blume's epithet, derived from a nomen nudum of Reinwardt (ex Blume Cat. Hort. 1823, p. 105), is better known than that of Thunberg we have chosen it as the correct one.

40. *Croton peltatum* Thunb. Fl. Jav. (1825) 23. — Java.

Based on *Ricinus tomentosus* Thunb. Diss. Ric. (1815) 6 = **Mallotus ricinoides** (Pers.) M. A.

38. *Croton reticulatum* Thunb. Fl. Jav. (1825) 23. — Ceylon.

This name is pre-empted by *C. reticulatum* Willd. (1805). According to Muell. Arg. it is *Coelodiscus thunbergianus* M. A. in DC. (1866). However, its identity is uncertain. Trimen (Handb. Fl. Ceyl. 3, p. 68) says it is doubtful and probably belongs to *Mallotus rhamnifolius* M. A. but Pax & Hoffmann distinguish it as a separate species allied to *M. eriocarpus* M. A. and gave it a new name *M. thunbergianus* (M. A.) P. & H. (Pfl. R. IV, 147, VII, 1914, 162). This, however, belongs in a section different from that of *M. rhamnifolius*.

33. *Justicia spathulata* Thunb. Fl. Jav. (1825) 22. — Java.

There are two specimens in Thunberg's Herbarium, both representing **Peristrophe bivalvis** (L.) Merr. The vernacular "boa cletong" cited by Thunberg as a Malay name is unknown to us. It is the common, cultivated form described under the name *Peristrophe tinctoria* (Roxb.) Nees which was formerly distinguished as a distinct species. The other specimen is also a *Peristrophe* which, however, in the absence of developed flowers, we cannot identify with any Malaysian species. It is not conspecific. The Ind. Kew. cited the species wrongly to be described in Thunb. Fl. Jap.

3. *Kaempferia speciosa* Thunb. Fl. Jav. (1825) 8.

This was identified by Wahlenberg as representing **Hedychium coronarium** Koen. in Retz. (1783).

26. *Lagerstroemia javanica* Thunb. Fl. Jav. (1825) 21. — Java. Incolis Pulaja.

The specimen represented is clearly identical with **Lagerstroemia speciosa** (L.) Pers.

11. *Lobelia javanica* Thunb. Mem. Ups. Append. V (1797) 105, nomen; Fl. Jav. (1825) 9. — e Java et Ceylona.

The specimen clearly represents **Pratia nummularia** (Lamk.) Kurz, as F. E. Wimmer already indicated on the sheet.

6. *Oldenlandia hirsuta* L. f. Suppl. (1781) 127; Thunberg, Fl. Jav. (1825) 8. — Java.

Thunberg's specimen undoubtedly represents the species described by the younger Linné and which is now called **Anotis hirsuta** (L. f.) Miq. ex Backer & Van Slooten, Geïllustr. Handb. Theeonkr. (1924) 203, not Hochr. (1925) as in Ind. Kew.

7. *Oldenlandia linearifolia* Thunb. Fl. Jav. (1825) 9. — e Java et Ceylona.

This is the common weed **Hedyotis corymbosa** (L.) Lamk.

9. *Oldenlandia longiflora* Thunb. Fl. Jav. (1825) 9. — Java.

This is a homonym of *O. longiflora* Lamk. which is now reduced to *Rondeletia pilosa*. Thunberg's specimen represents apparently a small-flowered **Ophiorrhiza** with awned stipules. Failing a revision of this difficult genus, we feel not justified to name it; nomenclaturally it has no value.

8. *Oldenlandia nudiflora* Thunb. Fl. Jav. (1825) 9. — Java.

The sheet represents a specimen of **Hedyotis ovatifolia** Cav.

10. *Oldenlandia triflora* Thunb. Fl. Jav. (1825) 9. — e Ceylona, incolis galapala.

There are 3 sheets, all marked Ceylon. All belong to the very common **Hedyotis biflora** (L.) Lamk.

4. *Ophrys lancea* Thunb. ex Sw. in Vet. Acad. Handl. Stockh. xxi (1800) 223, descr. !; Fl. Jav. (1825) 8. — Java.

This clearly represents *Spiranthes australis* Lindl. (1824). Apparently the oldest name is *Aristotelea spiralis* Lour. The epithet *spiralis*, however, can not be used in *Spiranthes* because of *Spiranthes spiralis* Koch (1849). The next two specific epithets are those of *Epidendrum aristotelia* Raeusch. 1797 and *Neottia sinensis* Pers. (1807). Both these names are typified by Loureiro's description. According to F. T. Hubbard (Bot. Mus. Leaflet. Harv. Univ. 4, 1937, 85—89) Raeuschel's epithet is illegitimate, but Persoon was fully justified in proposing a new epithet because of the combination *Neottia spiralis* Willdenow (1805), or rather (L.) Sw. ex Willd. — Willdenow had, apparently, accession to Swartz's text of the Fl. Ind. Occ. before it was published, since Willdenow in 1805 even cites the pages in Swartz, though Swartz's 3rd volume is dated, acc. to Pritzels, 1806.

The correct name seems therefore to be **Spiranthes lancea** (Thunb.)

B. B. S., comb. nov.

24. *Pandanus odoratus* Thunb. Fl. Jav. (1825) 19.

This specific name is questioned by Martelli, Webbia 4 (1913) 26, who doubted it to represent a *Pandanus*. To *Pandanus odoratissimus* L. f. Suppl. (1781) 26 was added "Thunb." In the same year Thunberg described *Keura odora* Thunb. Nov. Gen. Pl. 1 (1781) 26. Whether these names are all based on the same material of Thunberg is uncertain. This uncertainty is increased by the notes on the herbarium sheets marked fol., ♀ and ♂, which run: fol.: "e Java, Ceylona. C. P. Thunberg ex insula Mauritiana, malay pudak."; ♀: "e Ceylona Thunberg"; and ♂: "e Java, Ceylona. C. P. Thunberg. ex insula Mauritiana". The ♂ specimen has certainly inflorescences of 2 different species. The upper left partial inflor. of ♂ may belong to fol.

The description also presents some peculiar features, e.g. the "flowers" are stated to be "monoecious", which in Malaysian *Pandanus* is never the case.

It seems that the description is based on two different species. Moreover, we do not believe that the specimens have been collected in Java. They cannot be identified with the aid of Backer's key (Handboek Flora Java part 1, 1925, 36).



31. *Ruellia serrata* Thunb. in Nov. Act. Soc. Sc. Upsal. vii (1815) 143; Fl. Jav. (1825) 21. — Java.

According to the Ind. Kew. the original description of Thunberg referred to a Japanese species and was reduced by Nees in DC. Prod. 11: 161, to *Bonnaya penicillata* Nees. As Juel (l.c. p. 313) rightly remarked, the only specimen in Thunberg's herbarium, which we have examined is doubtless different from the plant of his original description, and, therefore, not its type specimen. It typifies his description of *Ruellia serrata* sensu Florula Javanica, and represents a specimen of *Ilysanthes ruelloides* (Colsm. 1793) O. K. (= *I. reptans* [Roxb.] Urban); the identity of the Japanese species needs clarification. A new synonym of this species is *Ilysanthes aristo-serrata* Hayata from Formosa.

32. *Ruellia tetragona* Thunb. Fl. Jav. (1825) 22. — e Java et Ceylona. The specimen represents **Artanema longifolia** (L.) Wettst. ex Bold. (1916).

22. *Triumfetta urticaefolia* Thunb. Fl. Jav. (1825) 19. — Ceylon.

This represents *T. suffruticosa* Bl. As both names date from 1825 it seems preferable to adopt Blume's name.

23. *Uvaria javanica* Thunb. Fl. Jav. (1825) 19. — Java.

This was reduced to *Unona tripetaloides* Dun. by Ind. Kew. However, there are two specimens, marked 1 and 2. No. 1 = **Canangium odoratum** (Lamk.) Baill. ex King, the other represents **Desmos chinensis** Lour. The description only refers to *Canangium*.

16. *Vitis trifoliata* Thunb. Fl. Jav. (1825) 11. — Surinam.

On the back of the sheet it is noted that the specimen came from Surinam where it was collected by Dahlberg. It is clearly identical with **Vitis erosa** (L. C. Rich.) Baker (*Cissus erosa* L. C. Rich.).

## NOTES ON THE FLORA OF JAVA, VI<sup>1)</sup>

by

Dr R. C. BAKHUIZEN VAN DEN BRINK

(Issued on 3. IV. 1950).

### Urticaceae, fam. CXXX.

Koorders, Fl. v. Tjibodas 2 (1923) 32—46; Hochreutiner in Candollea 2 (1924—1926) 336—359; Oehse, Indische Groenten (1931) 719—722; Baeker, Onkruidfl. Java Suiker (1930) 203—209; Amshoff in Blumea 5 (1942—1945) 515—517. Miss Dr G. J. Amshoff started the revision of the Javanese Urticaceae, but left the definitive preparation to me.

*Urtica dioica* L. and *U. urens* L. have been erroneously recorded for Java (Miquel, Fl. Ind. bat. 1<sup>2</sup>, 1859, 227; Koorders, Exk. Fl. Java 2, 1912, 126). To my knowledge no specimens were ever collected there nor elsewhere in the Malay Archipelago.

*Pilea angulata* (Bl.) Bl., Mus. Bot. Lugd. Bat. 2<sup>4</sup> (1852) 55 — *Urtica angulata* Bl., Bijdr. (1825) 464 — *Pilea stipulosa* (Miq.) Miq. in Zoll. Syst. Verz. (1854) 102 — *Urtica stipulosa* Miq., Pl. Jungh. 1 (1851) 28.

*Pilea glaberrima* (Bl.) Bl., Mus. Bot. Lugd. Bat. 2<sup>4</sup> (1852) 54 — *Urtica glaberrima* Bl., Bijdr. (1825) 493 — *Pilea smilacifolia* (Wall. ex Voigt) Wedd. in Ann. Sci. Nat. sér. IV, 1 (1854) 186 — *Urtica smilacifolia* Wall. ex Voigt, Hort. Suburb. Calcutta (1854) 279 — *Pilea miconiaefolia* Miq. in Zoll. Syst. Verz. (1854) 102, 106.

*Pilea leucophaea* (Bl.) Bl., Mus. Bot. Lugd. Bat. 2<sup>4</sup> (1852) 53 — *Urtica leucophaea* Bl., Bijdr. (1825) 493.

Amshoff, l. c. 515 considered this species (sphalm. *leucophaea*) conspecific with *Pilea subpuber* Miq., which is, however, a quite different plant.

*Pilea melastomoides* (Poir.) Bl., Mus. Bot. Lugd. Bat. 2<sup>4</sup> (1852) 54 — *Urtica melastomoides* Poir. in Lamk., Encycl. bot. suppl. 4 (1816) 223 — *Urtica trinervia* Roxb., Fl. Ind. 3 (1832) 582 — *Pilea trinervia* (Roxb.) Wight, Icon. (1852) t. 1973; Blume, Mus. Bot. Lugd. Bat. 2<sup>4</sup> (1852) 57 — *Pilea oreophila* (Miq.) Miq., Fl. Ind. bat. 1<sup>2</sup> (1859) 235 — *Urtica oreophila* Miq., Pl. Jungh. 1 (1851) 27 — *Pilea pellucida* Bl., Mus. Bot. Lugd. Bat. 2<sup>4</sup> (1852) 54.

*Pilea microphylla* (L.) Liebm. in Vidensk. Selsk. Skr. 5<sup>2</sup> (1851) 302; Blume, Mus. Bot. Lugd. Bat. 2<sup>4</sup> (1852) 44 — *Parietaria microphylla* L., Spec. Pl. 2 (1753) 1492.

*Pilea peploides* (Gaud.) Hook. et Arn., Bot. Beech. Voy. (1841) 96; Blume, Mus. Bot. Lugd. Bat. 2<sup>4</sup> (1852) 50 — *Dubruetia peploides* Gaud., Freyc. Voy. Bot. (1826) 495.

<sup>1)</sup> Note IV in Blumea VI, No. 1, 1948, 310.



**Debregeasia longifolia** (Burm. f.) Wedd. f. **dichotoma** (Bl.) Bakh. f., comb. nov. — *Urtica dichotoma* Bl., Bijdr. (1825) 499 — *Debregeasia dichotoma* (Bl.) Wedd. in Arch. Mus. Paris 8 (1855—1856) 462.

**Parietaria debilis** Forst. f. Cf. Van Steenis in Bull. Jard. Bot. Buitenzorg sér. III, 17<sup>4</sup> (1948) 400.

**Boehmeria glomerulifera** Miq. var. **neglecta** (Bl.) Bakh. f., comb. nov. — *Boehmeria neglecta* Bl., Mus. Bot. Lugd. Bat. (March 1856) 200.

**Chamabainia cuspidata** Wight. Cf. Amshoff in Blumea 5 (1942—1945) 593, 594.

JAVA, Western part, Preanger Regencies, Mt. Patoeha, alt. 1850 m: *Van Steenis* 6965 (L, BZ), collect. Dec. 1935, sterile, distr. sub *Droguetia pauciflora* Wedd.

The genus is new for Java. In Malaysia the plant is further only known from Lombok and Celebes.

**Gonostegia hirta** (Bl.) Miq. var. **crassissima** Bakh. f., var. nov. — Differt a typo characteribus sequentibus: folia crassissima, subtus in nervis elevatissimis pilis recurvis paucis munita, intra nervos et in costa glabra vel subglabra, nervis basalibus 3—4, robustis, ut costa vinosis.

JAVA, Western part, Preanger Regencies, above Bandoeng, alt. 1550 m: *Smith and Rant* 48 (L) type spec., dupl. in BZ, fl. Apr., distrib. sub *Memoralis hirta* Wedd. This variety might possibly be considered a distinct species.

**Procris pedunculata** (Forst. f.) Wedd. in DC, Prodr. 16<sup>1</sup> (1869) 191 — *Elatostemma pedunculatum* Forst., Char. Gen. (1776) 106 — *Procris longifolia* Bl., Bijdr. (1825) 508.

**Girardinia hibiscifolia** Miq., Pl. Jungh. 1 (1851) 31 — an? *Girardinia heterophylla* (Vahl) Decne in Jacquem. Voy. Bot. (1844) 151, t. 153.

This species which is usually considered identical with *Girardinia palmata* Gaud., is clearly distinct, as appears from the following key:

Stems and petioles densely clothed with patent, long grey hairs, mixed with numerous, in a dried state black stinging hairs; leaves herbaceous, thick, densely wooly beneath, deeply 5—9-cleft, with deeply incised, serrate lobes, petiole thick. Peduncle of the inflorescence much shorter than the spikes. . . . . **G. palmata** Gaud.

Stems and petioles densely clothed with strongly appressed, short hairs, mixed with few, in a dried state brown stinging hairs; leaves herbaceous, thin, the undersurface sparsely beset with appressed, short hairs, hence rather rough to the touch, slightly 3—7-lobed, with very coarsely serrate-dentate lobes; petiole slender. Peduncle of the inflorescence as long as the spikes or longer . . . . . **G. hibiscifolia** Miq.

**Elatostemma abangense** Amsh., spec. nov.

*Herba erecta tenera saepe simplex glaberrima 5—10 cm alta; caules basi tuberoso-incrassati, (his tuberebus probabiliter potius nodis caulinis habendis quam pro hypocotylis; vide observationes communicatas a L. van der Pijl in De Tropische Natuur 22 (1933) 93, hollandice); folia opposita dimorpha; folia normalia obliqua subsessilia grosse serrata, dentibus in utroque margine 3—7 late triangulatis acutiuseculis, glaberrima, nervis lateralibus in utroque latere costae 3—4 longe remotis, evenia 1—6 cm longa, 0.75—1.5 cm lata, superiora manifeste longiusecule caudato-acuminata, inferiora subovata rotundata; folia nana subfoliacea glabra circa 4 mm longa; stipulae ignotae probabiliter caducissimae et minutae. ♂ *Glomeruli* subumbellati e nodis caulinis tuberculatim incrassatis enati, pedunculis 2—3 cm longis; ♂ perianthii lobis 5 corniculatis vel ecorniculatis glabris circa 2 mm longis; ♀ *inflorescentiae* sessiles densae; perianthii lobis*

5 lineari-lanceolatis ecorniculatis apice longe pilosis circa 1 mm longis; fructus laeves 1 mm longi.

Java, Eastern part, Pasoeroean, Mt. Abang, near Mt. Tengger, alt. ca. 200 m, in forest: *Backer and Posthumus* 693 (L), type spec., fl. fr. Febr.

The affinity of this species is with *Elatostemma bulbiferum* Kurz in Journ. As. Soc. Beng. 42 (1873) II, 104, which has, however, the inflorescences distinctly stalked and differs further by having according to Kurz, the tubers arising from the thickening of a hypocotyl (which may be an erroneous statement).

*Missiessya* Gaud., Bot. Voy. Bonite (1844) t. 93 — *Leucosyke* Z. et M. in Moritzi, Zoll. Syst. Verz. (1845—1846) 76; Unruh in Ber. Deutsche Bot. Ges. 58 (1940) 484 and in Engl. Bot. Jahrb. 73 (1943) 191; both papers unavailable to me.

*Missiessya capitellata* (Poir.) Bakh. f., comb. nov. — *Urtica capitellata* Poir. Encycl. bot. suppl. 4 (1816) 227 — *Leucosyke capitellata* (Poir.) Wedd. in DC. Prodr. 16<sup>1</sup> (1869) 235.

#### Connaraceae, fam. CLIV.

*Connarus gracilis* Bakh. f. nom. nov. — *Connarus ellipticus* (Zoll.) Schell. in Candollea 2 (1925) 108, non *Connarus ellipticus* King in Journ. As. Soc. Bengal 66 (1897) 7.

#### Rutaceae, fam. CXLV.

Koorders, Fl. v. Tjibodas 2 (1923) 121—124; Baker f. in Journ. Bot. 62 (1924) Suppl. 15, 16; Hochreutiner in Candollea 2 (1924—1926) 406—410; Oehse, Indische Groenten (1931) 639—648.

*Micromelum minutum* (Forst. f.) W. et A., Prodr. 1 (1834) 448; Seem., Mission Fiji (1862) 434; Merrill, Enum. Philip. 2 (1923) 335; Hochreutiner in Candollea 2 (1924—1926) 408, 409 — *Limonia minuta* Forst. f., Fl. Ins. Austr. Prodr. (1784) 33 — *Micromelum pubescens* Bl., Bijdr. (1825) 128.

This species is extremely variable. All intergradating as the size of the flowers and the indumentum of the leaves have been found. *Micromelum pubescens* Bl. is only a form with larger flowers, but differs in no important additional feature from the typical *M. minutum* (Forst. f.) W. et A. which was once collected in Central Java.

*Euodia glabra* (Bl.) Bl., Bijdr. (1825) 245 — *Fagara glabra* Bl., Cat. (1823) 40, descr. — *Euodia aromatica* Bl., Bijdr. (1825) 246.

*Euodia incisifolia* Bakh. f., nom. nov. — *Evodia triphylla* Hort. Bog. ex Back., Schooffl. Java (1911) 179, non *Evodia triphylla* DC., Prodr. 1 (1824) 724.

*Euodia macrophylla* Bl., Bijdr. (1825) 246 — *Euodia accedens* Bl., Bijdr. (1825) 246 — *Euodia nervosa* K. et V. in Meded. 's Lands Plant. 17 (1896) 208.

*Euodia suaveolens* Scheff. var. *ridleyi* (Hochr.) Bakh. f., comb. nov. — *Evodia ridleyi* Hochr. in Icon. bog. (1904) t. 151.

*Euodia trichotoma* (Lour.) Pierre, Fl. Cochinch. (1893) t. 287 —



*Philagonia sambucina* Bl., Cat. (1823) 21, descr. — *Euodia sambucina* (Bl.) Hook. f. ex K. et V. in Meded. 's Lands Plant. 17 (1896) 216.

*Citrus medica* L., Spec. Plant. (1753) 782 — *Citrus javanica* Bl., Cat. (1823) 95, descr.; idem, Bijdr. (1825) 140.

*Glycosmis elongata* Bakh.f., nom. nov. — *Murraya longifolia* Bl., Bijdr. (1825) 137, non *Glycosmis longifolia* Tanaka, Studia Citrologia 2 (1928) 20.

*Glycosmis pentaphylla* (Retz.) Corr. var. *citrifolia* (Willd.) Bakh.f., comb. nov. — *Limonia citrifolia* Willd. Enum. pl. Hort. Berol. (1809) 449 — *Glycosmis citrifolia* (Willd.) Link in Trans. Hort. Soc. London 6 (1826) 72.

*Fagara backeri* Bakh.f., spec. nov.

*Frutex* scandens, usque ad 15 m altus; *ramuli* aculeati, aculeis recurvatis breviusculis, glabri; *folia* alterna imparipinnata, maiora circa 7—8-juga; rhachis foliorum 19—20 cm longus, in speciminibus floriferis aculeis recurvatis acutissimis munitus foliola plerumque opposita oblonga basi cuneata longiuscule obtuso-acuminata, in utrinque pagina glabra, integra vel crenulata crasse coriacea, in sicco sine punctis pellucidis 6.5—8 cm longa, 2.3—3.5 cm lata. *Paniculae* ad ramulorum apices aggregatae, saepe in paniculas terminales 30 cm longas confluentes longe pedunculatae; axis panicularum singularum pyramidaliter ramosus; axes laterales brevissimi inferiores oppositi, raro 3-verticillati, subhorizontales; *flores* ignoti; *fructus* constans a coccis, duobus quorum saepissime unus solummodo bene evolutus, alter abortivus; cocci evoluti obovoidei indehiscentes apice manifeste mucronulati 10—11 mm longi; *semina* lenticularia nigra, 7 mm longa.

Java, Western part, Preanger Regencies, Lengkong, in forest, alt. 700 m: *Backer* 17017 (BZ), type spec., fr. Nov.

The plant shows some resemblance with *Fagara torva* (F. v. M.) Engl. I have named it in honour of its discoverer, Dr C. A. Backer (Heemstede, Holland).

*Fagara oblongifolia* Bakh.f., spec. nov.

An? *frutex* scandens; *ramuli* ut rhachis foliorum et petioli modice dense aculeis curvatis parvis glabris obsiti, glabri; *folia* alterna; rhachis foliorum 6.5—19 cm longi; foliola 7, raro 5, oblonga vel lata lanceolata, basi cuneata saepe obliqua, acuminata, acumine retuso grosse crenata tenuiter coriacea translucida glabra, subtus in costa aculeis curvatis 1—3 mm longis minuta vel inermia punctis pellucidis ca. 50 magnis praedita, 5—7 cm longa, 2—3.5 cm lata, brevissime petiolata. *Paniculae* axillares brevissime pilosae inermes, pedunculo brevi computato, 2—7.5 cm longae; *flores* incompleti, solitarii vel 2—3 aggregati, 4-meri; pedicelli piloselli 2 mm longi; *sepala* ovata acutiuscula glabra 0.5 mm longa; *petala* ovato-oblonga 2—2.5 mm longa; *cocci* evoluti 1—4, apice rotundati mutici, glabri 5.5—7 mm longi; *semina* lenticularia nigra, 5—6 mm longa.

Java, Western part, Preanger Regencies, Mt. Megamendoeng: *Blume* 1814 (L), typus floris; Mt. Papandajan: *Blume* s.n. (L), typus fructus.

The plant shows some resemblance with *Fagara torva* (F. v. M.) Engl.

*Fagara pendjaluensis* Bakh.f., spec. nov.

*Frutex* aculeatus, ex Koorders non scandens, circa 2 m altus; *ramuli*, praecipue juniores pilis patentibus minutis dense vestitis, aculeati aculeis

gracilibus recurvatis acutis glabris circa 1 mm longis; *folia* alterna circa 2—4-juga, rhachi, petiolo communi brevi computato, 7—11 cm longo, aculeis minutis instructo; foliola opposita 3—7 ovalia vel late ovato-oblonga, basi rotundata vel late cuneata, brevissime acuminata laeviter crenulata vel sub-integra, juniora in utraque pagina sparse pilosiuscula, vetustiora in nervis solum pilosa, subtus in costa non vel vix aculeata subtus margine excepto punctis pellucidis magnis paucis ad permultis munita 4—7 cm longa, 2.5—3.5 cm lata, subsessilia; *paniculae* axillares racemiformes, pedunculo angulato pilosello circa 2 cm longo, axibus lateralibus brevissimis; *flores* ignoti; *fructus* cocci, quorum 2—3 normaliter evoluti glabri extus sulcato-venosi, endocarpio secedente circa 6 mm longi subsessilia; *semina* lenticularia, circa 5 mm longa, testa nigra.

J a v a, Western part, Preanger Regencies, islet of Noesa Gede in Lake of Pendjaleo in forest, alt. 720 m: *Koorders* 47693  $\beta$  (L), type spec., fr. Aug.

This plant shows resemblance with *Fagara torva* (F. v. M.) Engl., but the leaves are much smaller.

### Araliaceae, fam. CLIX.

*Koorders*, Fl. v. Tjibodas 2 (1923) 220—229; *Baker* f. in Journ. Bot. 62 (1924), Suppl. 44, 45; *Hochreutiner* in Candollea 2 (1924—1926) 481—490; *Heyne*, De Nutt. Pl. Ned. Ind. ed. 2, 2 (1927) 1207—1210; *Ochse*, Indische groenten (1931) 64—71; *Van Steenis* in Bull. Bot. Gard. Buitenzorg ser. III, 174 (May 1948) 390—395.

***Aralia dasyphylla*** Miq. var. ***urticifolia*** (Bl. ex Miq.) Bakh.f., comb. nov. — *Aralia urticifolia* Bl. ex Miq. in Ann. Mus. Bot. Lugd. Bat. 1 (1863—1864) 9.

***Aralia ferox*** Miq. Cf. *Van Steenis* in Bull. Bot. Gard. Buitenzorg ser. III. 174 (May 1948) 394.

***Aralia montana*** Bl. var. ***crassifolia*** Bakh.f., var. nov. — Differt a typo characteribus sequentibus: Petioli et rhaches foliorum dense piloselli; foliola crassiuscula tenuiter serrata, subtus pilis fulvis dense vestita.

J a v a, Western part, Preanger Regencies, Malabar: *Teysmann* s.n. (L); Batavia, Mt. Salak: *Koorders*  $\beta$  24141 (BZ, L), fr. Sept.; without locality: *Heinwardt* s.n. (L); idem: *Junghuhn* s.n. (L), type spec., sub H. L. B. 899.33—35.

***Boerlagiodendron moluccanum*** (Miq.) V. Ooststr., comb. nov. — *Trevesia moluccana* Miq., Fl. Ind. bat. 1<sup>a</sup> (1855) 748 — *Boerlagiodendron palmatum* (Zipp. ex Boerl.) Harms in Engl. u. Prantl, Die Nat. Pfl. Fam. 3<sup>s</sup> (1894) 31 — *Eschweilera palmata* Zipp. ex Boerl. in Ann. Jard. Buitenzorg 6 (1887) 116.

***Schefflera aromatica*** (Bl.) Harms in Engler u. Prantl, Die Nat. Pfl. Fam. 3<sup>s</sup> (1894) 38 — *Aralia aromatica* Bl., Bijdr. (1826) 871 — *Paratropia serrata* Miq., Fl. Ind. bat. 1<sup>a</sup> (1855) 757 — *Heptapleurum serratum* (Miq.) Seem. in Journ. Bot. 3 (1865) 79.

***Schefflera fastigiata*** (Miq.) Vig. in Ann. Sci. Nat. sér. IX, 9 (1909) 350 — *Paratropia fastigiata* Miq. in Ann. Mus. Bot. Lugd. Bat. 1 (1863—1864) 24 — *Heptapleurum laeve* K. et V. in Meded. 's Lands Plant. 42 (1900) 42 — *Schefflera laevis* (K. et V.) Kds., Exk. Fl. Java 2 (1912) 714, in clavi.

***Schefflera junghuhniana*** (Miq.) Harms in Engler u. Prantl, Die Nat.



Pfl. Fam. 3<sup>s</sup> (1894) 38 — *Paratropia junghuhniana* Miq., Fl. Ind. bat. 1<sup>a</sup> (1855) 758.

**Schefflera lucescens** (Bl.) Vig. in Ann. Sci. Nat. ser. IX (1909) 355 — *Aralia lucescens* Bl., Bijdr. (1826) 872.

I reduce the following species to varieties of this extremely polymorphic species.

1. var. **typica**. — *Aralia pergamacea* Bl., Bijdr. (1826) 873 — *Schefflera pergamacea* (Bl.) Vig. in Ann. Sci. Nat. ser. IX, 9 (1909) 350 — *Sciodaphyllum lucidum* Bl., Bijdr. (1826) 877 — *Paratropia lucida* (Bl.) Miq., Fl. Ind. bat. 1<sup>a</sup> (1855) 754 — *Sciodaphyllum longifolium* Bl., Bijdr. (1826) 876 — *Schefflera longifolia* (Bl.) Vig. in Ann. Sci. Nat. sér. IX, 9 (1909) 356, pr. p., typo incluso. — *Paratropia polyphylla* Miq., Fl. Ind. bat. 1<sup>a</sup> (1855) 760.

2. var. **grandifolia** (K. et V.) Bakh. f., comb. nov. — *Heptapleurum grandifolium* K. et V. in Meded. 's Lands Plant. 42 (1900) 40 — *Schefflera grandifolia* (K. et V.) Kds., Exk. Fl. Java 2 (1912) 714.

3. var. **rigida** (Bl.) Bakh. f., comb. nov. — *Aralia rigida* Bl., Bijdr. (1826) 874 — *Schefflera rigida* (Bl.) Harms in Engler u. Prantl, Die Nat. Pfl. Fam. 3<sup>s</sup> (1894) 38.

**Schefflera polybotrya** (Miq.) Vig. in Ann. Sci. Nat. sér. IX, 9 (1909) 352; Koorders, Exk. Fl. Java 2 (1912) 713; Hochreutiner in Candollea 2 (1924—1926) 486 — *Paratropia polybotrya* Miq., Fl. Ind. bat. 1<sup>a</sup> (1855) 755.

**Schefflera scandens** (Bl.) Vig. in Ann. Sci. Nat. sér. IX, 9 (1909) 348; Koorders, Exk. Fl. Java 2 (1912) 713 — *Sciodaphyllum scandens* Bl., Bijdr. (1826) 878.

**Schefflera subavenis** (Bl.) Hochr. in Candollea 2 (1924—1926) 485 — *Sciodaphyllum subavene* Bl., Bijdr. (1826) 876 — *Paratropia corona-sylvae* Miq., Fl. Ind. bat. 1<sup>a</sup> (1855) 755 — *Schefflera corona-sylvae* (Miq.) Vig. in Ann. Sci. Nat. sér. IX, 9 (1909) 305 — *Schefflera corona-sylvae* (Miq.) Kds., Exk. Fl. Java 2 (1912) 713 — *Paratropia brachybotrya* Miq., Fl. Ind. bat. 1<sup>a</sup> (1855) 755.

**Schefflera subavenis** (Bl.) Hochr. var. **eurhyncha** (Miq.) Bakh. f., comb. nov. — *Paratropia eurhyncha* Miq. in Ann. Mus. Bot. Lugd. Bat. 1 (1863—1864) 24 — *Heptapleurum eurhynchum* (Miq.) Seem. in Journ. Bot. 3 (1865) 78 — *Schefflera eurhyncha* (Miq.) Vig. in Ann. Sci. Nat. sér. IX, 9 (1909) 349.

#### Asclepiadaceae, fam. CLXXIII.

Beccari, Malesia 2 (1886) 248—275; Koorders, Fl. v. Tjibodas 3 (1918) 60—65; Hochreutiner in Candollea 6 (1934—1936) 474—482; Tsiang in Sunyatsenia 3<sup>2-3</sup> (May 1936) 160—239; idem in idem 4<sup>1-2</sup> (June 1939) 54—131.

**Phyllanthera bifida** Bl., Bijdr. (1826) 1048; idem, Mus. Bot. Lugd. Bat. 2<sup>s</sup> (Oct. 1849) 126, fig. XXII.

Of this apparently extremely rare species possibly two varieties occur in Java. The typical form possessing rather broad leaves, 2.5—3.5 times as long as wide, was found on Mt. Salak (in Western part). A form with very narrow leaves, 4—5.5 times as long as wide, has been found near

Tjadasmalang, S.W. of Bandoeng. Already King and Gamble in Journ. As. Soc. Bengal 74 (1908) 508, 509 paid attention to those differences in leaf-shape. The material at my disposal was too scanty to decide on the systematic value of this disparity.

**Finlaysonia obovata** Wall., Pl. As. Rar. 2 (1831) 48, t. 162; Merrill, Interpr. Herb. Amboin. (1919) 434 — *Finlaysonia maritima* Back. ex Heyne, De Nutt. Pl. Ned. Ind. ed. 2, 2 (1927) 1293, non *Secamone maritima* Bl., Bijdr. (1826) 1050.

**Atherandra** Deene in DC., Prodr. 8 (1844) 497 — *Atherostemon* Bl., Mus. Bot. Lugd. Bat. 2<sup>s</sup> (Oct. 1849) 126.

**Atherandra acuminata** Deene in l.c. (1844) 497 — *Atherandra acutifolia* Deene in l.c. (1844) 497 — *Atherandra cuspidata* Bl., l.c. 2<sup>10</sup> (Jan. 1850) 147 — *Atherandra pubescens* Bl., l.c. 2<sup>10</sup> (Jan. 1850) 147, fig. XXVI — *Atherostemon javensis* Bl., l.c. 2<sup>s</sup> (Oct. 1849) 126, fig. XXIII.

**Cryptostegia grandiflora** R. Br. in Bot. Reg. (1819) t. 435 — *Cryptostegia glaberrima* Hochr. in Ann. Conserv. et Jard. Bot. Genève 11—12 (1908) 89—91 — *Cryptostegia madagascariensis* Bojer, Hort. Mauriti. (1837) 212.

In my opinion this genus consists of one species only, though possibly varieties may be distinguished; the trifling differences do not warrant to treat *C. glaberrima* and *C. madagascariensis* as distinct species.

**Cryptolepis javanica** (Bl.) Bl., Mus. Bot. Lugd. Bat. 2<sup>10</sup> (Jan. 1850) 146, fig. XXV — *Leposma javanicum* Bl., Bijdr. (1826) 1049 — *Cryptolepis laxiflora* Bl. var. *obversa* Miq., Fl. Ind. Bat. 2 (1856) 467.

### **Cynanchum L.**

Thunberg, Observ. in Cynanch. (??) 7, 8 described two species said to occur in Java:

**C. capillare** Thunb. and **C. macrophyllum** Thunb. non Persoon. These plants are wholly unknown to me; possibly they do not belong to this genus.

**Cynanchum javanicum** (Kds.) Bakh.f., comb. nov. — *Marsdenia ? javanica* Kds. in Koorders-Schumacher, Syst. Verz. I, Java, Aselep. (1912), deser. brevis; Koorders, Exk. Fl. Java 3 (1912) 104.

**Cynanchum muricatum** (Bl.) Boerl., Handl. Fl. Ned. Ind. 2 (1899) 436; Tsiang in Sunyatsenia 4<sup>1-2</sup> (June 1939) 113.

**Cynanchum ovalifolium** Wight. Contr. (1834) 57; Merrill, Interpr. Herb. Amboin. (1917) 435; Heyne, De Nutt. Pl. Ned. Ind. ed. 2, 2 (1927) 1294 — *Cynanchum laeve* (Bl.) K. Schum. in Engl. u. Prantl, Die Nat. Pfl. Fam. 4<sup>2</sup> (1895) 292, non Persoon, Syn. 1 (1805) 27.

**Cynanchum zollingeri** (Miq.) Boerl., Handl. Fl. Ned. Ind. 2 (1899) 436 — *Cynoctonum zollingeri* Miq., Fl. Ind. bat. 2 (1856) 479.

I do not agree with Boerlage that Miquel's plant is identical with *Holostemma laeve* Bl. = *Cynanchum ovalifolium* Wight. Miquel emphatically stated the species to have membranaceous laeves; this is certainly not the case with *Cynanchum ovalifolium* Wight. I believe Miquel is correct in placing his plant in the vicinity of *C. dimidiatum* (Hassk.) Boerl. I have seen no material. It may be allied to *C. hoedimeerium* Bakh.f.

**Cynanchum hoedimeerium** Bakh.f., spec. nov.

*Sinistrorsum volubilis* caule gracili tenuiter pilosello; folia ovato-cordata vel triangulari-cordata, lobis basalibus rotundatis, saepe paulum con-



niventibus breviter atque acutissime acuminatis, in utraque pagina pilis longiuseculis albis sparsis praedita, 5-nervia subtus nervis lateralibus elevatis percurta, 3—12 cm longa, 2—9 cm lata, petiolo 2—5 cm longo; axillae foliorum saepe foliis falcato-subcordatis parvis brevipetiolatis praeditae.

*Flores* inter folios eiusdem jugi in inflorescentias racemiformes paucivel multiflores dispositi, 5-meri; *inflorescentiae*, pedunculo 0.8—2 cm longo computato, 1.5—4 cm longae, modice ad densiuscule patule pilosellae; pedicelli 4—9 mm longi; *calyx* ciliatus extus pilosellus; laciniae demum patulae, oblongae acutae virides, saepe purpurascentes 1.8—2 mm longae; *corollae* laciniae late patule pilosellae, intus glabrae, extus pallide virides intus praecipue in apice purpurascentes, 3—3.5 mm longae gynostegium inter coronae squamas in stipitem cylindricum valde carnosum 0.8—1 mm longum quam pars superior multo angustiore contractum; *pollinia* 0.25—0.35 mm longa, translatoribus duplo longiora; *corona* cupuliformis membranacea 2—2.5 mm alta, in margine superiori post singulam antheram lacinia lata praedita et cum ea alternans lacinia brevior atque angustior; coronae laciniae latiores apice breviter lobatae; lobus medius triangularis acutus ultra stigma porrectus; coronae laciniae angustiores lineares vel anguste triangulares integrae vel breviter 2—4-lobatae, circa 0.35 mm longae; *antherarum* membrana in stigmate accumbens semiorbicularis obtuso-rotundata irregulariter crenata; styli sibi appliciti longiuseculi; *folliculi* maturi ignoti, immaturi ovato-lanceolati acuminati uno latere applanati obscure tuberculati extus densiuscule patule et brevissime piloselli usque ad 9 cm longi; *semina* glabra.

Java, Western part, islet of Purmerend, in the Bay of Batavia: *den Hoed* and *van der Meer* 488 (L), type spec., fl. Apr. Eastern part, Tjabak, S.E. of Blora: *Koorders*  $\beta$  42517 (BZ), fl. Febr.; Asem Bagoes, E. of Sitoebondi, in bush, alt. 5 m: *Backer* 8209 (BZ), fl. May. Without locality: *Jungkuhn* s.n. (L), fl. fr.

Celebes, Mt. Padang: *Rachmat* (exp. Van Vuuren) 323 (L, BZ), fl. July.

Allied to *Cynanchum dimidiatum* (Hassk.) Boerl., but certainly not identical, differing e.g. by the structure of the flowers and the inflorescence.

This species has been named in honour of Mr. G. den Hoed and Mr. P. van der Meer, who together made very valuable collections of Javan plants; they collected mainly in the neighbourhood of Batavia.

*Ischnostemma carnosum* (R. Br.) Merr. et Rolfe in Philipp. Journ. Sci. 3 (1908) 121; Merrill, Enum. Philipp. Plants 3 (1923) 342 — *Oxytelma carnosum* R. Br., Prodr. (1810) 462 — *Cynanchum carnosum* (R. Br.) Schltr. in Perk. Fragm. Fl. Philipp. (1904) 120 non Hort. ex DC (1844); Domin in Bibliot. bot. 89 (1928) 531.

*Calotropis gigantea* (L.) Dryand. in Ait., Hort. Kew ed. 2, 2 (1811) 78; Greshoff, Nutt. Ind. Pl. 1 (1894) 153—156, t. 36; Merrill, Interpr. Herb. Amboin., (1917) 434, 435; Heyne, De Nutt. Pl. Ned. Ind. ed. 2, 2 (1927) 1293; Backer, Onkruidfl. Java Suiker (1931) 504, 505; Hochreutiner in Candollea 6 (1934—1936) 474; Tsiang in Sunyatsenia 4<sup>1-2</sup> (June 1939) 105, 106.

*Asclepias curassavica* L., Spec. Pl. (1753) 215; Backer, Onkruidfl. Java Suiker (1931) 503, 504; Hochreutiner in Candollea 6 (1934—1936) 474; Bruggeman, Indisch Tuinboek (1939), 102, fig. 74; Tsiang in Sunyatsenia 4<sup>1-2</sup> (June 1939) 102—104.

**Stephanotis floribunda** Brongn. in Ann. Sci. Nat. sér. II, 7 (1837) 30; Bruggeman, Indisch Tuinboek (1939) 66, fig. 22.

**Oxystelma esculentum** (L. f.) R. Br. in Mem. Wern. Soc. 1 (1809) 40; Tsiang in Sunyatsenia 4<sup>1-2</sup> (June 1939) 102.

**Secamone** R. Br., **Toxocarpus** W. et A. and **Genianthus** Hook. f.

A thorough revision of these genera and their nearest allies is highly desirable. I maintain them for the present, because I have not been able to study critically all species described. *Toxocarpus* and *Genianthus* consist of very heterogeneous elements, and I am convinced that a future, comprehensive revision of this group will show the existence of more than 3 genera. The suggestion that all these genera will have to be reduced to one genus only is, in my opinion, unwarranted. They show striking differences in habit.

**Secamone lanceolata** Bl., Bijdr. (1826) 1051 — *Secamone micrantha* (Decne) Decne in DC, Prodr. 8 (1844) 501; Tsiang in Sunyatsenia 4<sup>1-2</sup> (June 1939) 57 — *Tylophora micrantha* Decne in Nouv. Ann. Mus. Paris 3 (1834) 377. Decaisne's species is only a form with rather thin leaves. The type specimens of both species are in the Rijksherbarium, Leyden.

**Genianthus blumei** (Decne) Boerl., Handl. Fl. Ned. Ind. 2 (1899) 436 — *Toxocarpus blumei* Decne in DC, Prodr. 8 (1844) 506; Hochreutiner in Candollea 6 (1934—1936) 475 — *Secamone fulva* (Bl.) Kds., Exk. Fl. Java 3 (1912) 87 — *Secamone macrophylla* Bl. var. *fulva* Bl., Bijdr. (1826) 1050.

**Genianthus ellipticus** (Bl.) Bakh. f., comb. nov. — *Leptadenia ? elliptica* Bl., Bijdr. (1826) 1066 — *Secamone blumei* Decne in DC, Prodr. 8 (1844) 502.

**Toxocarpus insularis** (Miq.) Bakh. f., nov. comb. — *Secamone insularis* Miq., Fl. Ind. bat., Suppl. Sumatra (1862) 557.

**Toxocarpus maritimus** (Bl.) Miq., Fl. Ind. bat. 2 (1856) 476 — *Secamone maritima* Bl., Bijdr. (1826) 1050.

This plant is not identical with *Finlaysonia maritima* Baek. ex Heyne.

**Toxocarpus glaucus** Decne in DC, Prodr. 8 (1844) 505; Tsiang in Sunyatsenia 4<sup>1-2</sup> (June 1939) 71, 72, t. 20.

This species is unknown to me.

**Toxocarpus griffithii** Decne in DC, Prodr. 8 (1844) 505; Tsiang in Sunyatsenia 4<sup>1-2</sup> (June 1939) 77, t. 23.

**Toxocarpus longipetalus** Merr. in Univ. Calif. Publ. Bot. 15 (1929) 257; Tsiang in Sunyatsenia 4<sup>1-2</sup> (June 1939) 84.

Javanese specimens of this species are unknown to me.

**Toxocarpus villosus** (Bl.) Decne in DC., Prodr. 8 (1844) 506; Hochreutiner in Candollea 6 (1934—1936) 474; Tsiang in Sunyatsenia 4<sup>1-2</sup> (June 1939) 82, t. 25 — *Secamone villosa* Bl., Bijdr. (1826) 1050; Heyne, De Nutt. Pl. Ned. Ind. ed. 2, 2 (1927) 1294; Backer, Onkruidfl. Java-Suiker (1934) 505, 506.

**Toxocarpus rhopalophorus** Back., spec. nov.

*Volubilis*; *caules* tenues, novissimi pilis adpressis longiusculis crassis fuscis densiuscule obsiti, vetustiores glabri, cortici fusco verrucellis multis praedito; *folia* lanceolata vel ovato-lanceolata, basi rotundata, ad petiolo insertionem subcordata, sinu basali angustissimo acute acuminata, in utra-



que parte costae elevatae percursa nervis lateralibus multis late patentibus marginem non attingentibus tenuibus in siccio pallidis, in utraque pagina primo dense, dein sparse pilis adpressis longiuseculis crassis fuscis obsita, supra in siccio dense et tenuissime reticulate venosa, 4.5—7 cm longa, 1.85—2.75 cm lata; petiolus supra longitudinaliter sulcatus, primo dense appresse fusco-pilosus dein glaber. *Cymae* brevissime pedunculatae 4—6-flores, ramulis brevibus patulis, axibus densiuscule pilis adpressis fuscis obsitis; flores fragrantissimi; pedicelli tenues glabri 1.25—1.5 cm longi; *calyx* circa 2 mm altus, intus eglandulosus; lacinae ovato-triangulares, obtusae breviter ciliatae ceterum glabrae; *corolla* a basi usque ad laciniarum apicem 15—16 mm metiens; tubus anguste campanulatus ruber, extus glaber intus ornatus areis 5 longitudinalibus longe albo-pilosis cum laciniis corollae alternantibus; lacinae in alabastro sinistrorsae dein late patentibus lineares vel linearilanceolatae obtusae glabrae luteae 9—10 mm longae; *coronae* lobi staminibus paulum longiores 1 mm longi, apicibus liberis ovato-triangularibus 0.5 mm longis, intus prope apicem ligula subulata rubra corona paulum excedente 0.25 mm longo instructis; *antherarum* membrana brevissima; *pollinia* erecta obovata vel late oblonga 0.1—0.12 mm longa; stigmatis pars apicalis clavatus 3—3.5 mm longus, supra basin brevem tenuiter pedicelliformem valde inerassatus, ovato-fusiformis apice bifidis, lobis brevibus recurvis carnosus albis; *folliculi* maturi ignoti, immaturi lineares curvati obtuse acuminati glabri.

Java, Western part, Preanger Regencies, Tjidadap, S.W. of Tjibeber, alt. 900 m: *Winckel* s.n. (L), type spec., fl. Dec.

***Gymnema acuminatum*** Wall., Tent. Fl. Nep. (1825) 50; Moritzi in Moritzi, Zoll. Syst. Verz. (1845—1846) 57.

I am not convinced that Zollinger nr. 1655, from Java, belongs to this species, which to my knowledge occurs only in India. I have not seen Zollinger's original material which is probably in herb. Geneva.

***Gymnema syringaefolia*** (Deene) Boerl. Handl. Fl. Ned. Ind. 2<sup>2</sup> (1899) 437; Constant in Lecomte, Fl. Gén. Indo-Chine 4 (1912) 86; Merrill, Interpr. Herb. Amboin. (1917) 435, 436; Heyne, De Nutt. Pl. Ned. Ind. ed. 2, 2 (1927) 1295; Backer, Onkruidfl. Java Suiker (1931) 506, 507 — *Marsdenia syringaefolia* Deene in Ann. Sci. Nat. sér. II, 9 (1838) 275; Koorders, Exk. Fl. Java 3 (1912) 103, sub "*M. syringifolia* (Deene) Hook." — *Bidara syringaefolia* (Deene) Deene in DC, Prodr. 8 (1844) 623 — *Gymnema pubiflora* (Miq.) Hook. ex Kds. in Koorders-Schumacher, Syst. Verz. 1, Java (1912) Aselep., nomen nudum; Koorders, Exk. Fl. Java 3 (1912) 89 — *Bidara pubiflora* Miq., Fl. Ind. bat. 21 (1856) 497.

***Sarcolobus*** R. Br. (f. Greshoff, Schetsen Nutt. Ind. Pl. 1 (1894) 75, t. XX.

***Sarcolobus banksii*** R. et S., Syst. 6 (1819) 58; Koorders, Exk. Fl. Java 3 (1912) 88.

This is the only species known from Java with certainty.

***Sarcolobus spanoghei*** Miq., Fl. Ind. bat. 2 (1856) 502; Heyne, De Nutt. Pl. Ned. Ind. ed. 2, 2 (1927) 1295 and ***Sarcolobus narcoticus*** Span. ex Miq. Fl. Ind. bat. 2 (1856) 502 are unknown to me, but they may be identical with *Sarcolobus banksii* R. et S. or constitute varieties of it only.

The occurrence of ***Sarcolobus globosus*** Wall. (in As. Res. 12 (1816)

568, t. 5; Heyne, De Nutt. Pl. Ned. Ind. ed. 2, 2 (1927) 1295), in Java is up till now very doubtful.

**Dregea volubilis** (L. f.) Benth. et Hook. f., Fl. Brit. Ind. 4 (1883) 46 — *Asclepias volubilis* L. f., Suppl. (1781) 270 — *Marsdenia volubilis* (L. f.) Cooke, Fl. Bombay 3 (1908) 166 — *Wattakaka volubilis* (L. f.) Stapf in Bot. Mag. (1923) t. 8976; Tsiang in Sunyatsenia 4<sup>1-2</sup> (June 1939) 127 — *Dregea pubescens* (Miq.) Boerl., Handl. Fl. Ned. Ind. 2<sup>2</sup> (1899) 438; Koorders, Exk. Fl. Java, 3 (1912) 104; non N. E. Brown in Dyer, Fl. Cap. 4<sup>1</sup> (1909) 1029 — *Wattakaka pubescens* Miq., Fl. Ind. bat. 2 (1856) 496 — *Wattakaka viridiflora* (R. Br.) Hassk. in Flora 60 (1887) 99 — *Hoya viridiflora* R. Br. in Trans. Wern. Soc. 1 (1809) 27.

In my opinion *Wattakaka* is not generically different from *Dregea*.

**Heterostemma acuminatum** Deene in Ann. Sci. Nat. sér. II, 9 (1938) 268; Koorders, Exk. Fl. Java 3 (1912) 105 — *Heterostemma chrysanthum* (Hassk.) Boerl., Handl. Fl. Ned. Ind. 2 (1899) 438; Hochreutiner in Candollea 6 (1934—1936) 482 — *Symphysicarpus chrysanthus* Hassk. in Flora 60 (1857) 182 — *Heterostemma javanicum* Hassk. in Flora 60 (1857) 101.

**Telosma accedens** (Bl.) Back., comb. nov. — *Pergularia accedens* Bl., Bijdr. (1826) 1056 — *Pergularia apiculata* Warb. in Fedde, Rep. Spec. Nov. 3 (1907) 346 — *Pergularia bifida* Zipp. in Ann. Sci. Nat. sér. II, 9 (1838) 276 — *Pergularia puberula* Miq., Fl. Ind. bat. 2 (1856) 495 — *Marsdenia teysmanni* (Hassk.) Boerl., Handl. Fl. Ned. Ind. 2 (1899) 438 — *Tetragonocarpus teysmanni* Hassk. in Flora 60 (1857) 99.

**Telosma cordata** (Burm. f.) Merr. in Philipp. Journ. Sci. 19 (1921) 372; Heyne, De Nutt. Pl. Ned. Ind. ed. 2, 2 (1927) 1298.

Boerlage, Hand. Fl. Ned. Ind. (1899) 429 incorrectly stated the corolla in bud to be dextrorse; it is in fact sinistrorse, as Decaisne originally stated.

**Cosmostigma racemosum** (Roxb.) Wight, Contrib. bot. Ind. (1834) 42; Hook. f., Fl. Br. India 4 (1883) 46.

Hooker recorded this species for Java but up till now it has never been found in a wild state in this island, and it is but rarely cultivated there.

**Asterostemma repandum** Deene in Ann. Sci. Nat. sér. II, 9 (1838) 271, t. 10.

This extremely rare monotypic genus has been rediscovered by J. D. Dorgelo, W. of Grisse, Eastern Java, in the neighbourhood of the place where Leschenault probably found it for the first time, more than a century ago. This remarkable plant is easily recognizable by its repand-lobed, subhirsute, oblong-lanceolate leaves.

**Ceropegia curviflora** Hassk. in Flora 60 (1857) 102; Tsiang in Sunyatsenia 4<sup>1-2</sup> (1940) 290 — *Ceropegia horsfieldiana* Miq., Fl. Ind. bat. 2 (1856) 528; Tsiang in Sunyatsenia 4<sup>1-2</sup> (June 1939) 90.

**Streptocaulon horsfieldii** Miq., Fl. Ind. bat. 2 (1856) 470 — *Myriopterion horsfieldii* (Miq.) Hook. f., Fl. Br. India 4 (1883) 11.

The status of this Javan species has been much discussed. Most authors place it in the genus *Myriopterion*, but this is certainly incorrect, for the type specimen, preserved in the Kew Herbarium, possesses wingless fruits. In my opinion it is identical with *Streptocaulon extensum* Wight, Contrib. Bot. India (1834) 65: type specimen Wallich Asclep. nr. 128,



sub *Periploca extensa*. Tsiang in Sunyatsenia 4<sup>1-2</sup> (June 1939) 97 contrarily agrees with K. Schumann, who referred this species to *Myriopterion* (in Engler u. Prantl, Die Nat. Pfl. fam. 4<sup>2</sup> (1895) 215). It is unknown to me whether these authors examined Wallich's original material. In any case the Javan plant is extremely like old specimens from India, bearing the name *Streptocaulon extensum* Wight. The statement of Tsiang (in l.c. 98) that a representative of *Myriopterion* (*M. extensum*) occurs in Java is probably incorrect; to my knowledge this genus never has been found in the Malay Archipelago.

**Marsdenia crocea** (Zipp. ex Spanoghe) Hook. f. ex Boerlage, Handl. Fl. Ned. Ind. 2 (1899) 438; Koorders, Exk. Fl. Java 3 (1912) 103 — *Pergularia crocea* Zipp. ex Spanoghe in Linnaea 15 (1841) 323; Hooker f. in Fl. Br. India 4 (1883) 36, in nota.

Boerlage and Koorders erroneously ascribe to Hooker the transference of *Pergularia crocea* to *Marsdenia*. Hooker only pointed out the close alliance of this species with *Marsdenia tenacissima* W. et A., without considering them identical or even congeneric.

**Marsdenia stenocentra** Bakh. f., nomen novum — *Pergularia villosa* Bl., Bijdr. (1826) 1056 — *Marsdenia villosa* (Bl.) Bl. ex Miq., Fl. Ind. bat. 2 (1856) 493, non Hasskarl (1843).

**Marsdenia tinctoria** R. Br. in Mem. Wern. Soc. 1 (1809) 30; Heyne, De Nutt. Pl. Ned. Ind. ed. 2, 2 (1927) 1297, 1298; Tsiang in Sunyatsenia 3<sup>2-3</sup> (May 1936) 195, 196 — *Asclepias tinctoria* Roxb., Hort. Beng. (1814) 20, nomen nudum; idem, Fl. Ind. 2 (1832) 43 — *Marsdenia parviflora* (Bl.) Deene in Ann. Sci. Nat. sér. II, 9 (1838) 276 — *Pergularia parviflora* Bl., Bijdr. (1826) 1056.

This species was previously cultivated in Java. Blume's statement that the plant is a native of West Java is almost certainly incorrect.

**Tylophora astmatica** W. et A. in Wight, Contrib. Bot. India (1834) 51.

This species is erroneously recorded for Java. To my knowledge it has only been found in India and Ceylon, and it may have been found in Borneo. The Javanese specimens so named belong to *T. dorgelonis* Bakh. f. and *T. laevis* Deene.

**Tylophora cissoides** Bl., Bijdr. (1826) 106; Heyne, De Nutt. Pl. Ned. Ind. ed. 2, 2 (1927) 1296.

**Tylophora exilis** Colebr. in Trans. Linn. Soc. 12 (1818) 358, non? Schlechter (1904).

This species somewhat resembles *T. tenuis* Bl., but as a rule it is much more robust. Further it is easily recognizable by the shape of its corona scales. Specimens of *T. tenuis* Bl. with very large leaves have erroneously been considered to belong to *T. exilis* Colebr.

**Tylophora indica** (Burm. f.) Merr. in Philipp. Journ. Sci. 19 (1921) 373 — *Cynanchum indicum* Burm. f., Fl. Ind. (1768) 70 — *Tylophora astmatica* W. et A., according to Decaisne in DC, Prodr. 8 (1844) 611 — "*Tylophora cacumba* Willd." (? nomen) in ??; Boerlage, Handl. Fl. Ned. Ind. 2 (1899) 438.

I have not succeeded in identifying this species, which I have not seen, with any already known Javan species. I have found no earlier reference to Willdenow's name.

**Tylophora laevis** Decne in DC, Prodr. 8 (1844) 611 — *Tylophora asthmatica* W. et A. in errore apud Miquel, Fl. Ind. bat. 2 (1856) 489, quoad citatum javanicum; Koorders, Exk. Fl. Java 3 (1912) 91.

**Tylophora miquelii** Boerl., Handl. Fl. Ned. Ind. 2 (1890) 438 — *Hybanthera villosa* Miq., Fl. Ind. bat. 2 (1856) 490 — *Tylophora villosa* Bl.; Backer, Onkruidfl. Java Suiker (1934) 508.

This species has been found far below 500 m altitude.

**Tylophora rupestris** Bl., Bijdr. (1826) 1062; Koorders, Exk. Fl. Java 3 (1912) 90.

This species much resembles *T. tenuis* Bl. and *T. exilis* Colebr.; but is certainly specifically distinct. The flowers are unknown, but the very robust large, ovoid-lanceolate, obtuse follicles and few-flowered robust inflorescences are remarkable.

**Tylophora tenuis** Bl., Bijdr. (1826) 1062; Backer, Onkruidfl. Java Suiker (1931) 507, 508; Tsiang in Sunyatsenia 3<sup>2-3</sup> (May 1936) 254 — *Tylophora cuspidata* Zipp. ex Decne in Ann. Sci. Nat. sér. II, 9 (1838) 274, t. 10; Koorders, Exk. Fl. Java 3 (1912) 90.

This species is extremely variable, but all forms show the characteristic shape of the corona scales.

**Tylophora villosa** Bl., Bijdr. (1826) 1061; Backer, Onkruidfl. Java (1931) 508 — *Marsdenia villosa* (Bl.) Hassk. in Hoev. en de Vriese, Tijdschr. 10 (1843) 126, non Bl. ex Miquel, Fl. Ind. bat. 2 (1856) 493 — an? *Tylophora chlorantha* Miq., Fl. Ind. bat. 2 (1856) 486.

This species has not been found below 1000 m altitude. At lower altitudes it is replaced by the closely allied *T. miquelii* Boerl.

**Tylophora adnata** Bakh. f., spec. nov.

*Volubilis*; *caulis* densiuscule vel dense pilosellus; *folia* elliptica vel ovata, basi obtusa vel subcordata brevissime obtusiuscule acuminata, trochomatibus in seriebus duabus positis praedita, supra pilis nonnullis donata vel omnino glabra 4.5–8 cm longa, 2–4.5 cm lata, petiolo piloso 1 cm longo. *Flores* in cymas umbelliformes dispositi, pedunculo pilosello 5–8 mm longo; pedicellus pilosellus 8–13 mm longus; *calycis* laciniae ovato-lanceolatae acutae densiuscule longipilosae 2–3 mm longae; alabastra anguste ovoidea acuta; *corollae* tubus 2.5 mm longus; laciniae in alabastro distincte contortae acutae intus sparse pilosae longiuscule ciliatae; *coronae* lobi ab angulo interno usque ad angulum externum gynostegio circa dimidio longiores, angulo interno apicem antherae haud attingente, angulo externo rotundato; *stigma* globoso-conoideum; *pollinia* globosa magna translatoribus paulum minora, caudiculis aequilonga; *folliculi* ovoideo-lanceolati piloselli circa 7 cm longi, pedicello 1.5 cm longo; *semina* mihi ignota.

Java, Eastern part, near Ngadisari, alt. 2500 m: Koorders 37330  $\beta$  (L), type spec., fl. fr. Oct.; idem, alt. 2200–2500 m: Koorders 37324  $\beta$ , 37325  $\beta$ , 37329  $\beta$  (all L), fl. Oct. Celebes, S.W. part, Mt. Bonthain, alt. 1900 m: Binnemeyer 12154 (L), fl. June.

**Tylophora dorgelonis** Bakh. f., spec. nov.

*Volubilis*; *caulis* glaber; *folia* ovata, ovato-oblonga vel lanceolata 1.5–3.5  $\times$  longiora quam lata, basi rotundata vel subcordata, apicem versus sensim vel abrupte attenuata acute acuminata vel acutissima glabra vel subtus in costa solum pilosa, in sicco tenuiter coriacea evenulosa, sine (?)



trichomatibus 4—9.5 cm longa, 1.5—4.5 cm lata, petiolo glabro 1—2.5 cm longo. *Flores* in cymas umbelliformes breves apice bifidas vel simplices paucifloras dispositi; *cymae* inflorescentias subglabras 1—3.5 cm longas efformantes; pedicelli glabri vel sparse pilosi 8—18 mm longi; *alabastra* globosa vel late ovoidea apice rotundato-obtusa; *calycis* laciniae anguste ovatae acutae sparse pilosae vel subglabrae 2.5—4 mm longae; *corolla* saturate purpurea, laciniis intus in partibus apicalibus sparse vel dense pilosellis majusculis in sicco 4—5 mm longis; *coronae* lobi alte supra tubi staminei basin inserti, angulo externo late rotundati supra in parte media carina valde elevata instructi, non lateraliter compressa; *pollinia* ovalia 0.12 mm longa, caudiculis et translatoribus circa  $1.5 \times$  longiora; *folliculi* ignoti.

Java, Central part, Madioen, Sarangan, islet in lake, alt. 1200 m: *Docters van Leeuwen* 13072 (L), fl. Jan. Eastern part, Pasoeroean Nongkodjadjar, Aroeh Lawangan: *Dorgelo* 1385 (L), type spec., fl. Nov. Exact locality unknown, probably in Western part, beach: *Kuhl and van Hasselt* s.n. (L), fl. May.

This species has been named in honour of the late J. D. Dorgelo.

**Tylophora pilosissima** Bakh. f., spec. nov.

*Volubilis*; *caulis* dense vestitus pilis appressis brevibus luteis; *folia* ovato-oblonga vel oblonga basi rotundato obtusa brevissime acute acuminata penninervia nervis lateralibus 4—6, subtus venulosa, in utraque pagina praecipue subtus dense breviter pubescentia, sine trichomatibus, 3—5 cm longa, 1.5—3.5 cm lata, petiolo dense piloso 1—1.5 cm longo. *Flores* fasciculati; *fasciculi* in inflorescentias multoties bifurcatas dense pubescentes 3—10 cm longas dispositi; ramuli fractiflexi; pedunculus 1.5—3.5 cm longus; pedicellus sparse pilosellus circa 8 mm longus; *calycis* laciniae ovato-oblongae acutae sparse pilosae 1.5 mm longae; *corolla* viridi-lutea vel pallide lutea 4 mm longa; laciniae obtusae venulosae glabrae; *coronae* lobi parvi, basi tubi staminei inserti, angulo interno antheras circiter attingentes, angulo externo magno rotundato vel ovato, non lateraliter compressi obtusi; *pollinia* globosa minuta 0.06 mm diametentia; *folliculi* ignoti.

Java, Western part, Preanger Regencies, Tjidadap, S.W. of Tjibeber, alt. 1000 m: *Bakhuizen van den Brink* 2874 (L), type spec., fl. March; idem: *Winckel* 1811  $\beta$  (L), fl. Nov., v.n. areuj kaliworo.

### **Dischidia** R. Br.

This large genus urgently needs a thorough revision. As regards the Javan species it might be useful to mention here some important features for distinguishing groups within this genus. Firstly *Dischidia* can be split into a group with normal, flat leaves and a group with the leaves wholly or partially shaped otherwise: ascidiform, terete or watch-glass-shaped. Then the characters of the corona scales appear to be extremely important, not only for distinguishing complexes of species, but also for specific distinction. Three types of corona scales can be distinguished, viz.:

- (1) Scales more or less reniform (i. e. with large, rounded, often slightly excavate top and large, short or long, patent or downwards directed lobes).
- (2) Scales either sagittate, with attenuate, acute or truncate-emarginate top or ovate-triangular, with long acuminate top.
- (3) Scales with long hibrachiate top and narrow, cylindrical basal part.

For distinguishing species the characters of the pollination appa-

ratus, although of minor importance in comparison with the corona scales, are also useful, especially as a control of the specific identification. The shape and size of the pollinia, the length of the translator and the caudicles, and finally the ratio of their dimensions to each other. In some cases the absence or the presence of hairs on the inner side of the corolla lobes may be of importance, e. g. in the *rafflesiana*- and *imbricata*-group.

***Dischidia cochleata*** Bl., Bijdr. (1826) 1060 — *Dischidia imbricata*, apud auct. div., non Steud.

***Dischidia imbricata*** (Bl.) Steud., Nom. ed. 2, 1 (1840) 519; K. Schumann in Engl. u. Prantl, Die Nat. Pfl. Fam. 4 (1897) 289; Heyne, De Nutt. Pl. Ned. Ind. ed. 2, 2 (1927) 1296 — *Conchophyllum imbricatum* Bl., Bijdr. (1826) 1061; Merrill, Interpr. Herb. Amboin. (1917) 434 — *Dischidia collyris* Wall. Cf. Backer in De Trop. Nat. 1 (1912) 78.

***Dischidia nummularia*** R. Br., Prodr. (1810) 461; Merrill, Interpr. Herb. Amboin. (1917) 436, 437; Doeters van Leeuwen in De Trop. Nat. 2 (1913) 19, 20, fig. 1—3, 6—8; Heyne, De Nutt. Pl. Ned. Ind. ed. 2, 2 (1927) 1296 — *Dischidia gaudichaudii* Deene in DC, Prodr. 8 (1844) 632.

***Dischidia nummularia*** R. Br. var. ***glabra*** (Warb.) Bakh.f., comb. nov. — *Dischidia glabra* Warb. in Fedde, Rep. 3 (1907) 344.

***Dischidia nummularia*** R. Br. var. ***rhombifolia*** (Bl.) Bakh.f., comb. nov. — *Dischidia rhombifolia* Bl., Bijdr. (1826) 1059; Hochreutiner in Candollea 6 (1934—1936) 477 — *Dischidia horsfieldiana* Miq., Fl. Ind. bat. 2 (1856) 510.

***Dischidia rafflesiana*** Wall., Pl. Asiat. rar. 2 (1831) 35, t. 142; W. and J. Doeters van Leeuwen—Reynvaan in Ann. Jard. Bot. Buitenzorg 2e sér., 12 (1913) 76; M. A. Clerx in De Trop. Nat. 1 (1912) 113—117; Doeters van Leeuwen in De Trop. Nat. 2 (1913) 19—23, fig. 4, 9—12.

***Dischidia zollingeri*** Schltr. in Engl. Bot. Jahrb. 40 (1908) Beibl. 92, p. 11; Koorders, Exk. Fl. Java 3 (1912) 95 and ***Dischidia spironema*** Turez. in Bull. Soc. Nat. Moscou 25 (1852) II. 34, are quite unknown to me.

Boerlage, Handl. Fl. Ned. Ind. 2 (1899) 441, erroneously recorded ***Dischidia oxyphylla*** Miq. in Ann. Mus. Lugd. Bat. 4 (1868—1869) 141 for Java; he accepted it to be identical with *Hoya subquaterna* Miq. See also Koorders, Exk. Fl. Java 3 (1912) 96.

***Dischidia punctatoides*** Bakh.f., spec. nov. — *Dischidia punctata*, apud auct. div., non Blume; Doeters van Leeuwen in De Trop. Nat. 18 (1928) 59, 62.

*Epiphyticum; caulis gracilis primo praecipue circa nodos sparse pilosellus dein plerumque non omnino glaber, in sicco etuberculatus; folia plana ovata basi late rotundata vel raro subeordata, apice acuta vel breviter acuminata glabra etuberculata, in sicco manifeste penninervia 1.5—3.5 cm longa, 0.8—2.3 cm lata, subsessilia. Inflorescentia pauciflora, pedunculo gracili sparse piloso 5—15 mm longo; pedicellus sparse pilosus circa 3 mm longus; calycis lacinae ovatae obtusae sparsissime pilosellae; corolla in vivo 7.5 mm longa tubus intus ab insertione coronae usque ad fauces pilis sparsis erecto-patentibus obsitus; lacinae extus sordide purpureae verruculosae, intus glabrae; coronae lobi reniformes, basin versus abrupte contracti in stipitem cylindricum; lobi basales loborum coronae subhorizontales late*



rotundati brevissime; *pollinia* caudiculis et translatoribus fere duplo longiora 1.3 mm longa; caudicula crassa apicem versus elata et bifida, translatore paulum longiora; *folliculi* lanceolati acutissimi glabri 5—6 cm longi; *semina* coma 2.5 cm longa munita.

Java, Western part, Batavia, Mt. Halang near Buitenzorg, alt. 250 m: *Docters van Leeuwen* 8754 (L), type spec., fl. Nov.; Buitenzorg: *Docters van Leeuwen—Reynvaan* 5520 (L), fl. June; Tjiomas, near Buitenzorg: *Burck and de Monchy* s.n. (L); Mt. Wiroe, S.W. of Leuwiliang, alt. 700 m: *Balkhuizen van den Brink* 7264 (L), fl. Dec.; Mt. Salak: *Blume* s.p. (L), fl. Sept.; Bantam, Mt. Poeloesari: *Kuhl and van Hasselt* s.n. (L), fl. May. Eastern part, Besocki, Gending Waloe: *Koorders* 43180 ♀ (L), fl. July.

***Dischidia tjidadapensis* Bakh. f., spec. nov.**

*Epiphyticus*; *caulis* glaber; *folia* plana oblonda basi obtuso-cuneata apice acute acuminata glabra, in utraque pagina grosse venulosa tenuiuscula 5—6.5 cm longa, 2—2.5 cm lata, petiolo glabro 8 mm longo. *Inflorescentia* pauciflora; pedunculo gracili glabro 1—2.5 cm longo; pedicellus sparse pilosus circa 3 mm longus; *corolla* anguste ovoidea 3.5 mm alta basi ventricosa, intus longe infra lacinas annulo pilorum munita; lacinae intus glabrae; *coronae* lobi reniformes basin versus cylindraceo-attenuati; lobi basales coronae loborum angusti; *pollinia* anguste obovata, caudiculis aequilonga vel paulum breviora 0.3 mm longa; caudiculi translatore manifeste longiores; *folliculi* ignoti.

Java, originated from Western part, Preanger Regencies, Tjidadap, S.W. of Tjibeber, forest, alt. 1000 m, but cultivated in private garden, Buitenzorg: *Balkhuizen van den Brink* fil. 389 (U), type spec., fl. July.

***Hoya*** R. Br. Cf. Hooker f., Fl. Br. India 4 (1883) 52; Schumann in Engl. u. Prantl, Die Nat. Pfl. Fam. 4<sup>2</sup> (1895) 289; Schlechter in Engl., Bot. Jahrb. 50 (1914) 104—138; Tsiang in Sunyatsenia 3<sup>2-3</sup> (May 1936) 169.

This extremely difficult genus urgently needs a thorough revision; the taxonomic value of the characters proposed for distinction should be verified as much as possible by observations in vivo. In my opinion this genus is very natural. No useful purpose would be served by splitting it into small genera. The existing differences have no generic value. A division of *Hoya* into sections appears, however to be desirable as was already admitted by Hooker f. and K. Schumann.

***Hoya coriacea*** Bl., Bijdr. (1826) 1061; Hooker in Bot. Mag. (1 June 1850) t. 4518) — *Hoya fraterna* Bl., Rumphia 4 (1848) 32.

***Hoya coronaria*** Bl., Bijdr. (1826) 1063; Hooker in Bot. Mag. (1 March 1857) t. 4969.

***Hoya densifolia*** Turcz. in Bull. Soc. Nat. Moscou 21 (1848) I. 261; Backer in Ic. bog. (1909) t. 262.

***Hoya diversifolia*** Bl., Bijdr. (1826) 1064 — an? *Hoya crassipes* Turcz. in Bull. Soc. Nat. Moscou 21 (1848) I. 261 — *Hoya esculenta* (Rumph.) Tsiang in Sunyatsenia 3<sup>2-3</sup> (May 1936) 176 — an? *Hoya zolingeriana* Miq., Fl. Ind. bat. 2 (1856) 518.

***Hoya kühlī*** (Bl.) Kds., Exk. Fl. Java 3 (1912) 103 — *Acanthostemma kühlī* Bl. in Rumphia 4 (1848) 29 — an? *Acanthostemma longifolia* Bl. in Rumphia 4 (1848) 28 — *Hoya longifolia* (Bl.) Miq., Fl. Ind. bat. 2 (1856) 523.

*Hoya longifolia* (Bl.) Miq. is said to differ by having the corolla lobes glabrous within, but this statement might be incorrect as both species are

further extremely alike. Anyhow I consider the latter species a variety only.

**Hoya kuhlî** (Bl.) Kds. var. **hasseltii** (Bl.) Bakh. f., comb. nov. — *Acanthostemma hasseltii* Bl. in Rumphia 4 (1848) 29 — *Hoya hasseltii* (Bl.) Miq., Fl. Ind. bat. 2 (1856) 524.

**Hoya lacunosa** Bl., Bijdr. (1826) 1063; Docters van Leeuwen in De Trop. Nat. 18 (1928) 59, 61, 132; Hochreutiner in Candollea 6 (1934—1936) 477.

This species is extremely variable as to the shape and thickness of the leaves. It will be desirable to study these characters in the field. The colour of the flowers appears to be rather uniform, although Hochreutiner in l.c. 477 mentioned for Java a var. **pallidiflora** Hook. (in Bot. Mag. (1861) t. 5272); this variety is unknown to me.

**Hoya lasiantha** Korth. ex Bl. in Rumphia 4 (1848) 30; idem in Mus. Lugd. Bat. 14 (15 Apr. 1849) 60, fig. XIV; Beumée in De Trop. Nat. 14 (1925) 91, fig. 1 and 2.

**Hoya macrophylla** Bl., Bijdr. (1826) 1063 — an? *Hoya browniana* Kds. in Koorders-Schumacher, Syst. Verz. 1, Java (1912) Asclep.; idem, Exk. Fl. Java 3 (1912) 101 — *Hoya clandestina* Bl. in Rumphia 4 (1848) 32.

**Hoya multiflora** Bl., Cat. (1823) 49, descr.; idem, Bijdr. (1826) 1064 — *Centrostemma multiflorum* (Bl.) Decne in Ann. Sci. Nat. sér. 2, 9 (1838) 272; Chun in Sunyatsenia 1 (1934) 301; Tsiang in Sunyatsenia 3<sup>2-3</sup> (May 1936) 168 — *Centrostemma laurifolium* Bl., Mus. Bot. Lugd. Bat. 1<sup>3</sup> (Apr. 1849) 46 — *Cyrtoceras laurifolia* (Bl.) Miq., Fl. Ind. bat. 2 (1856) 514 — *Hoya javanica* Boerl., Handl. Fl. Ned. Ind. 2 (1899) 440.

**Hoya polystachya** Bl., Mus. Bot. Lugd. Bat. 2<sup>3</sup> (Apr. 1849) 45, fig. IX — *Hoya latifolia*, apud auct. div., non G. Don.

**Hoya puber** Bl. (sphalm. *pubera*), Bijdr. (1826) 1065; Backer in De Trop. Nat. 6 (1917) 188—190, fig. 4—6; Docters van Leeuwen in De Trop. Nat. 18 (1928) 138 — an? *Acanthostemma pictum* Bl., Mus. Bot. Lugd. Bat. 14 (15 Apr. 1849) 58, fig. X — *Hoya picta* (Bl.) Miq., Fl. Ind. bat. 2 (1856) 524, non aliorum.

Blume's last mentioned species is a not well known one. The figure given by Blume strikingly resembles *Hoya puber* Bl., but according to the description the flowers are purple-dotted.

**Hoya rumphii** Bl., Bijdr. (1826) 1065, excl. notis moluccanis; Merrill, Interpr. Herb. Amboin. (1917) 438.

There is much confusion about this insufficiently known but Javan species. The type specimen, from Java, preserved in the Rijksherbarium at Leyden, and Blume's original description agree very well. On the contrary Rumphius's plant, cited by Blume is not identical with the Javan species, as Merrill stated l.c.

**Hoya uncinata** T. et B. in Tijdschr. Ned. Ind. 25 (1863) 408.

This species is new for Java.

The following two species from Java are insufficiently known, and known to me only from literature:

**Hoya cinnamomifolia** Hook. in Bot. Mag. (1 Jan. 1848) t. 4347 and **Hoya purpureo-fusca** Hook. in Bot. Mag. (1 June 1850) t. 4520.

The vegetative parts of both species are extremely alike, but the colour of the flowers is totally different; moreover the absence or presence



of hairs on the innerside of the corolla lobes is an additional difference.

I have not been able to identify the following species mentioned for Java:

**Hoya laurifoliopsis** Hocr. in Candollea 6 (1934—1936) 477—479; **Hoya leembruggiana** Kds. (sphalm. *leembruggeniana*) in Koorders-Schumacher, Syst. Verz. 1, Java (1912) Asclep.; Koorders, Exk. Fl. Java 3 (1912) 100; **Hoya subquaterna** Miq., Fl. Ind. bat. 2 (1856) 525; **Hoya tjampeaensis** Hocr. in Candollea 6 (1934—1936) 479, 480.

**Hoya amoena** Bakh.f., spec. nov. — *Hoya purpurco-fusca*, apud Koorders, Exk. Fl. Java 3 (1912) 102, non Hook.

*Scandens*; *caulis* primo sparse pilosellus dein glaber vel subglaber; *folia* oblongo-lanceolata, nonnunquam subrhomboidea vel ovata basi acuta vel cuneata, raro obtusiuscula, acuta vel breviter acute acuminata, in sicco tenuiter sed valide coriacea subtrinervia vel uninervia, nervis lateralibus atque nervulis transversis superioribus vix a nervis basalibus diversis, glabra 8—11 cm longa, 3.5—4.5 cm lata, petiolo gracili glabro 8—15 mm longo. *Inflorescentia* umbelliformis quam maxime 20-flora pedunculo gracili pilosello 2.5—5.5 cm longo sustentata; pedicellus tenuis subglaber 15—18 mm longus; corolla horizontaliter patens 1 cm diametens; *calycis* lacinae ovato-triangulares obtusiuscule subglabrae 1 mm longae; *corollae* lacinae acutissimae, extus glabrae intus purpureae; *coronae* lobi ovali-triangulares, intima et extrema parte acutiusculi, supra leviter carinati; *pollinia* oblongo-obovata uno latere pellucide-marginata 0.6 mm longa, translatores plus quam duplo longiora; *folliculi* lineares obtusi sparse pilosi 18 cm longi.

Java, Eastern part, Besoeki, Poeger, alt. 10 m: Koorders 20341 ♂ (L), type spec., fl. Oct.; idem 20704 ♂ (L), fl. Oct.; idem, alt. 5 m: idem 20340 ♂ (L), fl. Oct.

**Hoya tenggerensis** Bakh.f., spec. nov.

*Scandens*; *caulis* glaber; *folia* ovato-oblonga basi rotunda apice breviter acuminata glabra 3—5-nervia, in area delimitata, nervis mediis cum 2 basalibus percursa nervis lateralibus pluribus qui crassitudine atque cursu nervis basalibus simillimi sunt, in sicco erasse coriacea supra manifeste subtus minus manifeste grosse venulosa, supra basin costae cella reniformi crassissimo (an? trichomatum podicem) instructa 10—12 cm longa, 5.5—6 cm lata, petiolo crassissimo glabro 1 cm longa. *Pedunculus* glaber 1.5—4 cm longus; pedicellus tenuis glaber 2.5 cm longus; *calyx* basi intus glandulis 5 munitus; laciniis ovatis obtuso-rotundatis extus primo sparse pilosellis, dein glabris 1.5 mm longis; *corolla* 1.8 cm diametens; lacinae apice recurvis acutis, extus glabrae intus densiuscule papilloso-pilosellae; *corona* lobi rhomboideo-elliptici, intima et extrema parte acuti, supra valide carinati; *pollinia* lanceolata marginibus parallelibus, basi abrupte contracta apice suboblique truncata uno latere pellucide marginata 0.9 mm longa, translatoribus circa ter longiora; *folliculi* ignoti.

Java, Eastern part, Paseroean, Mt. Pengger (= ? Tengger), forest, alt. 1500 m: M. Buysman 301 (U), type spec., fl. Aug.

**Hoya tjadasmalangensis** Bakh.f., spec. nov.

*Scandens*; *caulis* glaber sparse verruculatus; *folia* late ovata basi rotunda breviter acutiuscule acuminata glabra 5-nervia, supra grosse verrucosa in sicco crassissime coriacea 19.5 cm longa, 12 cm lata, petiolo crassissimo 3.5 cm longo. *Inflorescentia* subumbelliformis permultiflora, pedunculo

gracili subglabro 2 cm longo; *calycis* laciniae anguste triangulares acutae subglabrae 1 mm longae; *corolla* horizontaliter patens parvula in siccio 6 mm diametens; laciniae ovatae acuminatae glabrae 3 mm longae; *coronae* lobi ovati, angulo externo late rotundi vel retusi, angulo interno acuti, subtus vix gibbosi; *pollinia* anguste oblonga marginibus fere parallelibus, apice in uno latere obliqua membranaceo-marginata 0.3 mm longa, translatores 4  $\times$  longiora; caudicula obsoleta; *folliculi* ignoti.

Java, Western part, Preanger Regencies, Tjadasmalang, near Tjidadap, S.W. of Tjibeber, forest, alt. 1000 m: *Winkel* 448  $\beta$  (L), type spec., fl. Oct., v.n. kikandel; idem: *Bakhuizen van den Brink* 2481 (L), fl. Apr.

***Hoya vitellinoides* Bakh. f., spec. nov.**

*Scandens*; *caulis* glaber; *folia* oblonga basi obtusa breviter et acute acuminata in utraque pagina sparissime brevissime pilosella erasse coriacea penninervia nervis lateralibus 4—6 in utraque pagina conspicuis percursa irregulariter transverse venulosa sine (?) trichomatibus 14—16 cm longa, 7—7.5 cm lata, petiolo crasso 7.5—10 mm longo. *Inflorescentia* mihi ignota; pedicellus tenuis densiuscule pilosellus 2.5 cm longus; *calycis* laciniae anguste triangulares obtusiusculae ciliatae sparissime puberulae 1 mm longae; *corolla* fere plana (?) lutea in siccio circa 8 mm diametens; laciniae elliptico-oblongae abrupte acute acuminatae, oculis in-armatis intus fere glabrae, sub lente fortiusculo sparse munitae squamulis rotundis vel pilis stellatis minutis, 3.5 mm longae; *coronae* lobi angusti, ambitu plus minus triangulari-cultriformes, angulo externo sublinguiformes, apice anguste triangulari supra valide carinati, angulo interno e basi lato late triangulari acuto; *coronae* squamarum pars connata (gynostemium includens) multo quam duplo brevior parte libera anguli externi; *pollinia* oblanceolata apice oblique cuneato, translatores fere duplo longiora; caudicula nulla; *folliculi* ignoti.

Java, Western part, Batavia, Mt. Tjipoetih, near Tjiampea, alt. 800 m: *Bakhuizen van den Brink* 4181 (L), type spec., fl. Sept.

Resembling somewhat *Hoya vitellina* Bl., but differing by the characters of the corona scales and the pollination apparatus.

***Heynella* Back., genus novum, e tribu *Marsdeniae*, ex affinitate *Stephanotis* Thou.**

*Suffruter* epiphyticus non volubilis, an? lactiferus; *folia* opposita penninervia trichomatibus praedita petiolata. *Flores* in cymas terminales umbelliformes pedunculatas aggregati; *calyx* profunde 5-partibus, an? intus glandulis ornatus; laciniae alternantes cum saccis protuberantibus haud profundis corollae baseos; *corolla* subhypocrateriformis; tubus lageniformis, supra singulas calycis lacinias plica prominente longitudinali munitus; laciniae 5 in alabastro valvatae dein erecto-patentes, tubo multo breviores; *coronae* squamae staminibus insertae, in parte basali tubi staminei bene evoluti, lateraliter compressi, apice oblique truncati, ad angulum internum continuati in carinam angustam, acumine libero carentes; *antherarum* membrana stigma valde excedens; *pollinia* in antherarum loculis solitaria erecta; stigma latiusculum apice anguste conoideum; *ovaria* glabra; styli liberi; *folliculi* desiderantur.

***Heynella lactea* Back., spec. nov.**

*Suffruter* 0.25—0.30 m longae; *caulis* glaber; *folia* ovato-oblonga vel



ovato-lanceolata, basi acuta subattenuata, apicem versus sensim attenuata, acuta vel acuminata, subtus costa valde elevata et nervibus lateralibus patentissimis marginem non attingentibus percursa 6.5—8.5 cm longa, 1.75—3.25 cm lata, petiolo 4—6 mm longo. *Cymae* circa 8-flores, pedunculo glabro 1.25 cm longo; pedicelli glabri circa 3 mm longi; *calyx* corollae basi ad pressus late explanatus 2—2.5 mm diametrens; laciniae inter saccos basales tubi corollini abditae ovato-ovales; *corolla* tenuiter carnosa cremicolor extus glabra; tubus 7.5—8 mm longus intus in virgis latis inter plicas, praecipue in parte superiore, densiuscule longipilosus; laciniae ovato-oblongae acutae intus glabrae 2.25—2.75 mm longae; *coronae* lobi crassiusculi 1.5 mm alti, dorso sulco longitudinali percursi, angulo externo rotundati; *antherarum* membranae erectae ovato-oblongae 1.5 mm longae; styli glabri.

Java, Western part, Preanger Regencies, Tjadasmalang, near Tjidadap, S.W. of Tjibeber, forest, alt. 1200 m: *Docters van Leeuwen* 2719 (BZ), type spec., fl. Sept.

This genus is closely allied to *Stephanotis* Thou., differing however by the following characters: inflorescence terminal; calyx lobes alternating with bulges of the corolla base; corolla-tube with 5 prominent folds; corona lobes compressed, without free apex; membrane of the anther-tips far exceeding the stigma; epiphytic, not scandent half-shrub.

The genus is dedicated to the memory of K. Heyne (1877, Amsterdam; †, 1947, Bennekom), from 1906—1927, Head of the Museum for Economic Botany at Buitenzorg; author of the justly renowned *Nuttige Planten van Nederlandsch Indië* (Useful plants of the Netherland East Indies).

#### Loganiaceae, fam. CLXX.

Koorders, Fl. v. Tjibodas 3 (1918) 44—49; Heyne, De Nutt. Pl. Ned. Ind. ed. 2, 2 (1927) 1267—1271; Backer, Onkruidfl. Java Suiker (1931) 484—488.

**Cynoctonum mitreola** (L.) Britt. var. **lilacinum** (Back. apud Cammerl.) Bakh. f., comb. nov. — *Mitreola paniculata* Wall. ex G. Don var. *lilacina* Back. apud Cammerl. in Bull. Jard. Bot. Buitenzorg sér. III, 5<sup>4</sup> (1923) 299.

**Fagraea elliptica** Roxb., Fl. Ind. ed. Carey, 2 (1824) 32 — *Fagraea kimangu* Bl., Mus. Bot. Lugd. Bat. 1<sup>11</sup> (Febr. 1850) 173.

**Fagraea javanensis** (Bl.) Bakh. f., comb. nov. — *Picrophloeus javanensis* Bl., Bijdr. (1826) 1020; idem, Rumphia 2 (1836) 36, in observ.; idem, Mus. Bot. Lugd. Bat. 1<sup>11</sup> (Febr. 1850) 173.

**Fagraea lanceolata** Bl., Bijdr. (1826) 1021 — *Fagraea oxyphylla* Miq., Fl. Ind. bat. 2 (1856) 371.

**Fagraea obovata** Wall. ex Roxb., Fl. Ind. ed. Carey, 2 (1824) 33 — *Fagraea blumei* G. Don, Gen. Hist. 4 (1838) 69 — *Fagraea blumei* Steud., Nomenclat. ed. 2, 1 (1840) 624.

**Fagraea obovata** Wall. ex Roxb. var. **brevicalyx** Bakh. f. var. nov. — *Fagraea obovata-javana* Bl.; Koorders-Schumacher, Syst. Verz. 1, Java, Logan. (1912) pro parte — *Fargaea vaginata* King et Gamble; S. Moore in Journ. Bot. 63 (1925) Suppl. 69 — differt a typo notis sequentibus: flores 15—50; calyx 8—12 mm altus, sepalis 4—5 mm longis; petala elliptico-oblonga crassiuscula intus valide longitudinaliter venosa 1.5 cm longa. Ceterum ut typus.

Java, Western part, Tjibodas: *Docters van Leeuwen* s.n. (L), typus floris, fl. Oct.; Eastern part, Pantjoer, Idjen: *Koorders* 28595  $\beta$  (L), typus fructus, fr. Aug.

Occurring throughout Java and apparently much commoner than the typical form.

***Fagraea pusilliflora*** Bakh. f., spec. nov. — *Fagraea elliptica* Roxb.; *Koorders-Schumacher*, Syst. Verz. 1, Java, Logan (1912) pro parte.

*Arbor*; *ramuli* glaberrimi; *stipulae* intrapetiolares basi connatae 2 mm altae; *folia* oblonga vel late lanceolata basi acuta, apice attenuata non vel vix acuminata obtusiuscula, glabra crassissime coriacea, in utroque latere costae percursa nervis lateralibus 8—12, horizontalibus-subascendentibus, supra inconspicuis, subtus manifestis et saepius validiusculis, obsolete venosa 10—17 cm longa, 4—6 cm lata, petiolo circa 1.5 cm longo. *Flores* 5-meri, in cymis multifloris glabris; cymae in anthelas terminales 7—11 cm longas digestae; bracteae minutae inferiores anguste triangulares 1 mm longae, sursum decrescentes et tandem ovato-triangulares; *calyx* campanulatus glaber 1.75 mm longus; calycis tubus 1 mm longus, laciniis aequans; lacinae semiorbiculares subfimbriatae; tubus corollinus cylindricus glaber 3—6 mm altus, calyce 2—3-plo longior; *petala* lanceolata obtusa glabra 2 mm longa, intus costa valida et nervis lateralibus 2 tenuioribus percursa; *stamina* 5 in fauce, alte exserta, filamentis glabris maxime 1 cm longis; antherae oblongae; *stylus* filiformis glaber 7—10 mm longus; *cocci* globosi apice styli rudimento coronati, in sicco 3—4 mm diametientes.

Sumatra, Palembang, Banjoeasin and Koeboelands, forest, alt. 15 m: *Endert* 77 E, 1 P. 746 (L), type spec., fl. March; idem: *Endert* 77 E. 1 P. 933 (L), fl. Sept., v.n. banda tijoeng; Lematang Ilir, alt. 75 m: *Bosch-proefstation* F. 684 (L), fr. Aug.; without exact locality: *Forbes* 3142 (L).

Java, Western part, Batavia, N. of the Tjianten, S. of Leuwiliang, near Buitenzorg, alt. 700 m: *Backer* 25948 (L), fr. Sept.; Mt. Salak, near dessa Bobodjong, alt. 1000 m: *Koorders* 24247  $\beta$  (L), fr. Sept.; Preanger Regencies, Sanggrawa, Djampang Koelon, alt. 400 m: *Koorders* 4348  $\beta$  (L).

### Oleaceae, fam. CLXXI.

*Koorders*, Fl. v. Tjibodas 3 (1918) 40—44; Heyne, De Nutt. Pl. Ned. Ind. ed. 2, 1 (1927) 1264—1267; *Backer*, Onkruidflora Java Suiker (1931) 479—482.

***Jasminum multiflorum*** (Burm. f.) Andr., Bot. Rep. (1801) t. 496, non Roth (1821) — *Nyctanthes multiflora* Burm. f., Fl. Indica (1768) 5, t. 3, fig. 1 — *Jasminum pubescens* Willd., sensu latissimo.

This species is extremely variable as to the indumentum of the young twigs, leaves, pedicels and calyx, the shape of the leaves and to a certain degree also the dimensions of the calyx-lobes. Intermediate forms are very common; therefore I reduced the following species to forms of *Jasminum multiflorum* (Burm. f.) Andr.

f. ***acuminatissimum*** (Bl.) Bakh. f., comb. nov. — *Jasminum acuminatissimum* Bl., Mus. Bot. Lugd. Bat. 1<sup>18</sup> (Oct. 1850) 276.

f. ***glabriusculum*** (Bl.) Bakh. f., comb. nov. — *Jasminum glabriusculum* Bl., Bijdr. (1826) 679.

f. ***pubescens*** (Willd.) Bakh. f., comb. nov. — *Jasminum pubescens* Willd., Spec. Pl. 1 (1797) 37, sensu stricto.



f. **subelongatum** (Bl.) Bakh. f., comb. nov. — *Jasminum subelongatum* Bl., Mus. Bot. Lugd. Bat. 1<sup>18</sup> (Oct. 1850) 274 — *Jasminum affine* Bl., Mus. Bot. Lugd. Bat. 1<sup>18</sup> (Oct. 1850) 274 — *Jasminum mirtinervium* Bl., Mus. Bot. Lugd. Bat. 1<sup>18</sup> (Oct. 1850) 273 — *Jasminum pedale* Bl., Mus. Bot. Lugd. Bat. 1<sup>18</sup> (Oct. 1850) 274 — *Jasminum pendulum* Bl., Mus. Bot. Lugd. Bat. 1<sup>18</sup> (Oct. 1850) 275 — *Jasminum quinquenervium* Bl., Mus. Lugd. Bat. 1<sup>18</sup> (Oct. 1850) 278 — *Jasminum subpubescens* Bl., Mus. Lugd. Bat. 1<sup>18</sup> (Oct. 1850) 274 — *Jasminum vulcanicum* Bl., Mus. Bot. Lugd. Bat. 1<sup>18</sup> (Oct. 1850) 276.

### Apocynaceae, fam. CLXXII.

Koorders, Fl. v. Tjibodas 3 (1918) 54—60; Heyne, De Nutt. Pl. Ned. Ind. ed. 2, 2 (1927) 1271—1293; Hochreutiner in Candollea 5 (1931—1934) 176—182; Backer, Onkruidfl. Java Suik. (1930) 493—592; Tsiang in Sunyatsenia 3<sup>2-3</sup> (May 1936) 121—161; idem in idem 4<sup>2-3</sup> (June 1939) 54—131; Pichon in Bull. Mus. Paris, 2e sér., 20 (1948) 296—303 (Classification of the *Ecdysanthereae*).

**Catharanthus roseus** (L.) G. Don, Gen. Syst. (Febr. 1838) 95 — *Lochnera rosea* (L.) Reichb., Consp. (Dec. 1838) 134, nomen nudum — *Lochnera rosea* (L.) Reichb. ex Endl., Gen. Pl. (Aug. 1838) 583; van Welsum in De Trop. Nat. 5 (1916) 52; Backer, Onkruidfl. Java Suiker (1931) 494, 495; (1931) Van Steenis in De Trop. Nat. 23<sup>2</sup> (1934) 31—33.

**Catharanthus roseus** (L.) G. Don var. **angustus** Van Steenis ex Bakh. f., var. nov. — *Lochnera rosea* (L.) Reichb. ex Endl. var. *angusta* V. Steenis in De Trop. Nat. 25 (1936) 18, hollandice — differt a typico corollae laciniis albis sese non tangentibus.

Java, Western part, Buitenzorg, spont. in private garden, alt. 250 m: Van Steenis s.n. (L), type spec., fl. Jan.

**Melodinus** Forst. Cf. Pichon in Mém. Mus. Paris nouv. sér. XXIV, 3 (1948) 125—130.

**Melodinus orientalis** Bl., Bijdr. (1826) 1026; Heyne, De Nutt. Pl. Ned. Ind. ed. 2, 2 (1927) 1271; Tsiang in Sunyatsenia 2<sup>2-3</sup> (May 1936) 133 — *Melodinus laxiflorus* Bl., Mus. Bot. Lugd. Bat. 1<sup>10</sup> (Jan. 1850) 155 — *Willughbeia umbrosa* Bl., Mus. Bot. Lugd. Bat. 1<sup>10</sup> (Jan. 1850) 154.

According to Blume *Melodinus laxiflorus* differs from this species in having a puberulous corolla throat, but I could find no hairs in the type specimen. Even if Blume is right I am not inclined to consider this character sufficient for specific distinction.

**Melodinus laevigatus** Bl., a closely related species, was wrongly mentioned by Miquel for Java.

**Landolphia gummifera** (Lamk.) K. Schum. in Bot. Jahrb. 15 (1892) 409 — *Vakea gummifera* Lamk., Illustr. (1797) 292, t. 169; Miquel. Fl. Ind. bat. 2<sup>1</sup> (1856) 394.

Formerly cultivated in Java for its latex, but since long out of use. In the Leyden Herbarium much old material from Java is present. The vernacular name was apparently "ojod gember".

**Willughbeia** Roxb. Cf. Pichon in Mém. Mus. Paris nouv. sér. XXIV 3 (1948) 153.

This genus seems to be extremely rare in Java. The only native species is *W. firma* Bl., in recent time with certainty found only near Rangkasbetoeng (Western part) and possibly also on Mt. Smeroe (Eastern part).

**Chilocarpus** Bl., Cat. (1823) 22, descr.; idem, Bijdr. (1826) 1025; idem, Mus. Bot. Lugd. Bat. 1<sup>10</sup> (Jan. 1850) 151—153; Pichon in Mém. Mus. Paris nouv. sér. XXIV, 3 (1948) 163.

**Chilocarpus suaveolens** Bl., Cat. (1823) 23, descr. — *Chilocarpus compositus* Bl., Mus. Bot. Lugd. Bat. 1<sup>10</sup> (Jan. 1850) 152 — *Chilocarpus densiflorus* Bl., l. c. (Jan. 1850) 152 — *Chilocarpus globuliferus* Bl., l. c. (Jan. 1850) 152 — *Chilocarpus suaveolens* Bl. var. *borneensis* Hall. f. in Kaoutsch.-lianen (1900) 150, p. p., typo excl. — *Chilocarpus suaveolens* Bl. var. *salaccensis* Hochr. in Candollea 5 (1931—1934) 176.

**Chilocarpus denudatus** Bl. Bijdr. (1826) 1025 — *Chilocarpus atroviridis* Bl., Mus. Bot. Lugd. Bat. 1<sup>10</sup> (Jan. 1850) 153.

**Urnularia** Stapf in Hook. Ic. Pl. 28 (1901) t. 2711; Pichon in Mém. Mus. Paris nouv. sér. XXIV, 3 (1948) 154.

**Plumeria** L. Cf. Van Steenis in De Trop. Nat. 26<sup>4</sup> (1937) 63—66.

**Plumeria acuminata** Ait., Hort. Kew. ed. 2, 2 (1811) 70; Van Steenis in l. c. (1937) 63—66, fig. 1—3 — *Plumeria acutifolia* Poir. in Lamk., Encycl. Suppl. 2 (1812) 667.

**Dyera** Hook. f. Cf. Monachino in Lloydia 9 (1946) 64.

In Java **Dyera costulata** (Miq.) Hook. f. was formerly only cultivated in Java. Fruiting specimens are unknown to me.

**Ervatamia** Stapf in Dyer, Fl. Trop. Africa 4 (1902) 126; Merrill in Contrib. Arnold Arb. (1934) 139; Pichon in Not. Syst. 13<sup>3</sup> (Jan. 1948) 230—253.

As I have to confine myself almost exclusively to the Java species, it is beyond the scope of this study to disentangle *Tabernaemontana* in the widest sense. Merrill in l. c. considered *Ervatamia* generically not different from *Tabernaemontana*, but Pichon agrees with Stapf. As a rule recent botanists keep those 2 genera apart, referring the Australasiatic species to *Ervatamia* s. l., those of Africa, Madagascar and America to *Tabernaemontana* and other allied genera.

**Ervatamia sphaerocarpa** (Bl.) Burk. in Kew Bull. (1935) 317 — *Tabernaemontana sphaerocarpa* Bl., Bijdr. (1826) 1028; Heyne, De Nutt. Pl. Ned. Ind. ed. 2, 2 (1927) 1283; Hochreutiner in Candollea 5 (1931—1934) 177; Backer, Onkruidfl. Java Suiker (1931) 496 — *Pagiantha sphaerocarpa* (Bl.) Mgf. in Not. Bot. Gart. Berl. 12 (1936) 546 — *Tabernaemontana fagraeoides* Miq., Fl. Ind. bat. 2<sup>1</sup> (1856) 420 — *Tabernaemontana javanica* Miq., Fl. Ind. bat. 2<sup>1</sup> (1856) 422.

**Ervatamia floribunda** (Bl.) Pichon in Mém. Mus. Paris, sér. 11, 27 (1948) 220 — *Tabernaemontana floribunda* Bl., Bijdr. (1826) 1026; Backer, Onkruidfl. Java Suiker (1931) 495.

**Ervatamia blumeana** Mgf. in Not. Bot. Gart. Berlin 12 (1936) 547 — *Tabernaemontana pauciflora* Bl., Bijdr. (1826) 1028, non *Ervatamia pauciflora* Ridley in Journ. As. Soc. Straits Br. 86 (1922) 299.

**Ervatamia blumeana** Mgf. var. **macropetala** Bakh. f., var. nov. — Differt a typo notis sequentibus: tubus corollinus 23 mm longus; laciniis 17 mm longis; antherae in sicco 3.5 mm longae; stylus 17 mm longus.



Java, Central part, Soebah, forest, alt. 50 m (*Koorders* 27301 $\beta$ , L, type spec., fl. Apr.).

The type species has respectively the following measurements: 13—17 mm, 7—9 mm, 2—2.5 mm and 13—15 mm.

**Ervatamia pubescens** (R. Br.) Mgf. var. **glaberrima** Bakh.f. var. nov. — Differt a typo notis sequentibus: ramuli, folia et inflorescentiae glaberrimi; folia mucronulata, non ut in typo breviter acuminata.

Java, Western part, Buitenzorg, cult. in Botanical gardens sub nr. IV E 28, alt. 250 m: *Hallier* f. s.n. (L), type spec., fl. July; Buitenzorg, escaped along the rivulet Tjidepit, alt. 250 m: *Bakhuizen van den Brink* fil. 914 (U), fl. Sept.

**Voacanga grandifolia** (Miq.) Rolfe var. **glabrifolia** Bakh.f., var. nov. — Differt a typo foliis glabris.

Java, Eastern part, Kediri, Gadoengan (*Koorders* 22725 $\beta$ , (L), fl. June, v.n. alantong; Kediri, alt. 60 m: *Lörzing* 796 (L), fl. Febr.; Rogodjampi: *Koorders* 126 $\beta$  (L), type spec., fl. Febr.; idem: *Koorders* 123 $\beta$ , 124 $\beta$ , 28843 $\beta$  (L), all fl. Aug.; Poeger: *Koorders* 20359 $\beta$  (L), fl. Oct., v.n. kalonton; idem: *Koorders* 22615 $\beta$  (L), fl. March, v.n. alakontong; Banjoewangi: *Reinwardt* s.n. (L).

Exact locality unknown: *Teysmann* s.n. (L).

**Rauwolfia** L. Cf. Pichon in Bull. Soc. Bot. France 94, 1—2 (1947) 31—39.

For correct determination specimens with well developed flowers and especially ripe fruits are indispensable. A revision of the Malaysian species is urgently needed. Observations on living material are much desired.

**Rauwolfia reflexa** T. et B. in Nat. Tijdschr. Ned. Ind. 3 (1852) 329; idem in Ned. Kruidk. Arch. 3 (1855) 405 — *Rauwolfia blumeana* Val. ex Kds.—Schum., Syst. Verz. 1, Java, Apoc. (1912), nomen nudum — *Rauwolfia sumatrana*, apud Auct. div., non Jack, quoad specimina javana.

**Rauwolfia serpentina** (L.) Benth. et Hook., Gen. Pl. 2 (1876) 697; Kurz, For. Fl. Brit. Burma 2 (1877) 171; Backer, Onkruidfl. Java Suiker (1931) 499 — *Ophioxylon serpentinum* L., Spec. Pl. (1753) 1043 — *Ophioxylon majus* Hassk. in Flora 28 (1845) 295 — *Ophioxylon trifoliatum* Gaertn.; Miquel, Fl. Ind. bat. 2<sup>1</sup> (1856) 404 — *Hunteria sundana* Miq., Fl. Ind. bat. 2<sup>1</sup> (1856) 409; Hallier f. in Meded. Rijksherb. Leiden 1 (1910) 26.

I agree with Hallier's identification.

**Rauwolfia serpentina** (L.) Benth. et Hook. var. **obscura** (Miq.) Bakh.f., comb. nov. — *Ophioxylon obversum* Miq., Fl. Ind. bat. 2<sup>1</sup> (1856) 405.

**Rauwolfia spectabilis** (Miq.) Benth. et Hook., Gen. Pl. 2 (1876) 697; Boerlage, Handl. Fl. Ned. Ind. 2<sup>2</sup> (1893) 393 — *Cyrtosiphonia spectabilis* Miq., Fl. Ind. bat. 2<sup>1</sup> (1856) 402 — *Cyrtosiphonia madurensis* T. et B., Cat. (1866) 125, nomen nudum — *Rauwolfia madurensis* Burck ex Kds.—Schum., Syst. Verz. 1, Java, Apoc. (1912) descr.

**Ochrosia** Juss. Cf. Pichon in Bull. Mus. Paris, 2e sér., 2 (1947) 205—212.

**Ochrosia akkeringae** (T. et B.) Miq. in Ann. Mus. Lugd. Bat. 4 (1868—1869) 138, sphalm. "ackeringae" — *Lactaria akkeringae* T. et B. in Tijdschr. Ned. Ind. 21 (1867) 249 — *Ochrosia borbonica* Auct. non Gmel.

**Cerbera** L. Cf. Corner in M. A. H. A. Magazin 8 (1938) 49; Pichon in Not. Syst. 13, 3 (Jan. 1948) 221—224.

**Cerbera manghas** L., Spec. Pl. (1753) 208; Corner, Wayside Trees

Malaya (1940) 143; idem in l.c. (1938) 208; Pichon in l.c. (1948) 223, 224 — *Cerbera lactaria* Ham. in DC, Prodr. (1830) 353; Valetton in Ann. Jard. bot. Btzg. 12 (1895) 245; Ridley, Fl. Mal. Penins. 2 (1923) 339.

Usually considered conspecific with *C. odollam* Gaertn. Some authors considered the latter to represent only a variety of this species. However, several recent authors who have studied the living plants agree that this view is incorrect. The two species although resembling each other closely in habit, particularly in dried specimens with not yet fully developed flowers, are well distinct. E.g. in *C. manghas* the corolla throat is red, in *C. odollam* it is yellow. Pichon considered then even to represent two distinct sections.

**Parameria laevigata** (Juss.) Moldenke in Rev. sudameric. bot. 6 (1940) 76—78 — *Aegiphila laevigata* Juss. in Ann. Mus. Paris 7 (1806) 76 — *Parsonia barbata* Bl., Bijdr. (1826) 1042 — *Parameria barbata* (Bl.) K. Schum. in Engl. und Prantl, Die Nat. Pfl. Fam. 4 (1895) 162 — *Echites densiflora* Bl., Bijdr. (1826) 1040 — *Ecdysanthera barbata* (Bl.) Miq., Fl. Ind. bat. 2<sup>1</sup> (1856) 451 — *Ecdysanthera barbata* (Bl.) Miq. var. *angustior* Miq., Fl. Ind. bat. 2<sup>1</sup> (1856) 451 — *Parameria angustior* (Miq.) Boerl., Handl. Fl. Ned. Ind. 2<sup>2</sup> (1899) 399.

Mr. Pichon informed me (in litt.) that *Aegiphila laevigata* Juss. (type no. 5037) is really identical with *Parameria barbata* (Bl.) K. Schum.

**Anodendron tenuiflorum** Miq. in Ann. Mus. Lugd. Bat. 4 (1868—1869) 140; Heyne, De Nutt. Pl. Ned. Ind. ed. 2, 2 (1927) 1290, 1291.

According to Heyne records of its occurrence in Java are unreliable; it is said to occur in the eastern part. I know it only with certainty to occur in the western part.

**Aganosma velutina** D. C., Prodr. 8 (1844) 434 — *Aganosma blumei* D. C., Prodr. 8 (1844) 433; Tsiang in Sunyatsenia 4<sup>1-2</sup> (June 1939) 38 — *Aganosma euloba* Miq., Fl. Ind. bat. 2<sup>1</sup> (1856) 447.

**Beaumontia multiflora** T. et B. in Ned. Kruidk. Arch. 3 (1855) 393 — *Beaumontia khasiana* Hook. f., Fl. Br. India 3 (1882) 661.

This species is cultivated in Java under the name of *Beaumontia grandiflora* Wall. However, this is a totally different species, which, to my knowledge, does not occur in Java.

**Ichnocarpus frutescens** (L.) R. Br. in Mem. Wern. Soc. 1 (1809) 62 — *Ichnocarpus dasycalyx* Miq., Fl. Ind. bat. 2<sup>1</sup> (1856) 449.

**Trachelospermum inflatum** (Bl.) Pierre ex Pichon in Bull. Mus. Paris 2e sér., 20 (1948) 191 — *Echites inflata* Bl., Bijdr. (1826) 1039.

**Ecdysanthera** Hook. et Arn.

This continental genus is wrongly recorded for Java.

**Nerium indicum** Mill.

This is the only species cultivated in Malaysia. Statements that *N. oleander* L. occurs in this region must be considered incorrect. Although it is very difficult to give good differential characters, the Mediterranean *N. oleander* L. is rather easily recognisable by its habit. The delimitation of the species of *Nerium* is somewhat confused. Perhaps they all belong to one polymorphic species *N. oleander* L.

**Urceola**, **Chavannesia** and **Xylinabaria**. Cf. Pichon in Bull. Mus. Paris, 2e sér., 20 (1948) 296 seq.

Pichon reestablished the genus *Chavannesia*, which most authors reduce to *Urceola*. *Chavannesia* has i. a. 4-seriate ovules, *Urceola* 6-seriate ones. Both genera have valvate or quineuncial corolla lobes, while the closely allied genus *Xylinabaria* differs by dextrorse petals. I have not incorporated *Xylinabaria* in the Flora of Java, as at that time too scanty material was at my disposal, but according to Pichon two species occur in Java, viz: *X. bantamensis* Pierre ex Pichon and *X. koordersii* Pierre ex Pichon.

A short time ago Pichon kindly put at my disposal specimens of those 2 species.

**Xylinabaria bantamensis** Pierre ex Pich.

J a v a, Western part, Bantam, Mt. Karang, 1200 m: *Koorders* 40124  $\beta$  (P), type spec., (BZ), dupl. typ., fl. Nov.; Priangan, Tjigenteng, 1400 m: *Koorders* 26315  $\beta$  (L, BZ, P), fl. Jan.

*Koorders*, Syst. Verz. 1, Java (1912) Apoc., published these two nrs. sub *X. koordersii* Pierre msc.

**Xylinabaria koordersii** Pierre ex Pich.

J a v a, Western part, Priangan, Pelaboean ratoe: *Koorders* 24456  $\beta$  (P), type spec., (BZ), dupl. typ., fl. Nov.

**Urceola brachysepala** Benth. et Hook. f., Gen. Pl. 2 (1876) 716; Boerlage in Bull. Inst. Bot. Buit. 5 (1900) 17; Van Romburgh in Teysmannia 11 (1901) 342—344 — *Chavannesia brachysepala* (Hook. f.) Pich. in Bull. Mus. Paris, 2e sér., 20 (1948) 302.

J a v a, Western part, Batavia, Nirmala, 1100 m: *Backer* 11023 (L), fl. Dec. Central part, Kediri, Mt. Wilis, 1100—1150 m: *Backer* 11560 (L), fl. Febr.

**Urceola lucida** Benth. et Hook. f., Gen. Pl. 2 (1876) 716 — *Urceola brachysepala* Benth. et Hook. f.; Boerlage in Bull. Inst. Bot. Buitenzorg 5 (1900) 18, pr. p.

J a v a, Bantam, Mt. Tjibitoeng: *Van Romburgh* 2 (L), fr. Aug.; Moentjang: *Van Romburgh* 3 (L), ster. Batavia, Buitenzorg, along the Tjiliwoeng: *Hasskarl* s.n. (L); Depok, alt. 93 m: *Beumée* 6725 (L) fl. May; idem: *Smith and Rant* 683 (L), fr. Oct.; idem: *Backer* 22125 (L) fl. Apr.; Barengkok, W. of Buitenzorg, alt. 200 m: *Bakhuizen van den Brink* 6436 (L), fl. June; Bodjong Enjot, N.E. of Buitenzorg: *Bakhuizen van den Brink* 6361 (L), fl. June; Pasir Honjè, near Leuwiliang, alt. 250 m: *Bakhuizen van den Brink* 6735 (L), fl. Apr.; idem: *idem* 6783 (L), fl. June. Preanger Regencies, Tjissalak: coll. unknown (L), ster.; idem, cult.: *Koorders* 42204  $\beta$  (L), fl. Apr.. Exact locality unknown: *Blume* s.n. (L).

New for Java. Javanese specimens of this species have been mainly distributed as *Urceola javanica*.

**Chonemorpha** G. Don, Gen. Syst. 4 (1836) 76; Furtado in Gard. Bull. Str. Settle. 9 (1935) 115; Chatterjee in Kew Bull. (1947) 47—52.

**Chonemorpha fragans** (Moon) Alst. in Ann. Roy. Bot. Gard. Peraden. 11 (1929) 203 — *Echites fragans* [Rheede] Moon, Cat. (1821) nomen, sed non nomen nudum (cf. art. 36 of the Rules) — *Chonemorpha macrophylla* (Roxb.) G. Don, Gen. Syst. 4 (1836) 76; Tsiang in Sunyatsenia 32-3 (May 1936) 152, 153 — *Chonemorpha mollis* Miq., Fl. Ind. bat. 2<sup>1</sup> (1856) 444.

**Chonemorpha mollissima** Boerl., Handl. Fl. Ned. Ind. 2<sup>2</sup> (1899) 389, deser. brevis.



Descriptio emendata huc addita: *Ramuli* juniores dense fusco-piloselli, vetustiores subglabrescentes sed nunquam glaberrimi; *folia* late ovalia-oblonga, basi paulum contracta obtuso-rotundata, ex apice rotundato breviter acute acuminata vel acutiuscula, supra in nervis sparse piloselli ceterum glabra, subtus dense molliter puberula, nervis lateralibus in utraque parte costae 8—12, densissime venosa et venulosa, 12—18 cm longa, 8—12 cm lata; petioli crassi breviter dense piloselli 1.5—2 cm longi. *Inflorescentiae* terminales, e cymis 2—3 cm longis 5—10-floris compositae; pedunculi dense fusco-piloselli 5—7 cm longi; bracteeae utrinque dense piloselli, ad 1 cm longae; pedicelli dense piloselli 1—1.3 cm longi; *calyx* late pyriformis, basi truncatus, apice distincte contractus, extus densiuscule pilosellus intus glaber et basi squamulis multis ornatus; tubus circa 1.5 cm longus; laciniae late triangulares acutae apice revoluta minutae 2 mm longae; *tubus corollinus* calyceem paulum excedens 1 cm longus extus glaber, intus dense barbatus; laciniae oblongae apice suboblique rotundatae 1.5 cm longae; *stamina* paulum supra corollae basin affixa; filamenta glanduloso-pilosella minuta; antherae sagittatae 5.5 mm longae; *fructus* ignoti.

(?) Java, locality unknown: Reinwardt s.n. (L), type spec.

This species is closely allied to *C. penangensis* Ridley, differing slightly in minor characters. As I have too scanty material of both species at my disposal I will postpone a decision, but if in future these two species appear to be identical, the oldest name *C. mollissima* Boerl. will have to be used. I am grateful to Dr D. Chatterjee, of Kew, for his suggestion. *C. mollissima* Boerl. has not been taken up in the emergency edition of the flora of Java, as it is not certain that this species occurs in this island.

**Microchites** Miq., Fl. Ind. bat. 2<sup>1</sup> (1856) 456; Boerlage, Handl. Fl. Ned. Ind. 2<sup>2</sup> (1899) 380 — *Otopetalum* Miq., Fl. Ind. bat. 2<sup>1</sup> (1856) 400; idem in Versl. en Meded. Kon. Akad. Wet. 6 (1857) 191.

**Microchites micrantha** (Miq.) Hall. f. in Kaoutsch.-lanen (1900) 150 — *Otopetalum micranthum* Miq., l.c. (1856) 400; idem in l.c. (1857) 191 — *Microchites schrieckii* (v. Heurck et M. Arg.) Rolfe in Journ. Bot. 23 (1855) 214 — *Tabernaemontana polyantha* Bl., Bijdr. (1826) 1029, pr. p., typo excl.

I wholly agree with Boerlage that *Otopetalum* must be reduced to *Microchites* and that what Miquel considered to be baccate fruits are in fact corolla tubes, deformed by insects. As otherwise normal floral and vegetative parts have been used for describing this new genus, I cannot regard Miquel's name contrary to art. 65 of the Rules.

**Rhynchodia slootenii** (Tsiang) Tsiang comb. nov. — *Trachelospermum slootenii* Tsiang in Sunyatsenia 4 (1939) 29.

Professor Tsiang kindly informed me in litt., that his *Trachelospermum* must be reduced to *Rhynchodia*, which conclusion I reached also independently by comparing the types of *Rh. slootenii* (Tsiang) Tsiang and the closely related second Javan species *Rh. verrucosa* (Bl.) Woods.

**Alyxia** Banks ex R. Br.

It is commonly assumed that in Java one species of this genus occurs, known either as *Alyxia stellata* (Forst.) R. et S. or as *Gynopogon reinwardti* (Bl.) Kds. But a closer study revealed that at least 4 species can be distinguished, viz: *A. reinwardti*, *lucida*, *cinerea* and *winckeli*; the latter

two species being new. The true *Alyxia stellata* (Forst.) R. et S. is a Pacific species, probably not occurring in Western Malaysia.

***Alyxia reinwardti*** Bl. var. ***latifolia*** (Bl.) Bakh.f., comb. nov. — *Alyxia stellata* (Forst.f.) R. et S. var. *latifolia* Bl., Bijdr. (1826) 1031.

***Alyxia cinerea*** Bakh.f., spec. nov.

*Scandens*; *ramuli* praecipue juniores et *paginae superiores* foliorum juveniliū sparse griseo-piloselli; *ramuli ipsi* subquadrangulares, in sicco pallidi; *folia* 3-verticillata, lanceolata basi cuneata, in petiolos attenuata, apice obtuse acuminata, coriacea, supra, costa depressa pilosella excepta, glabra, nervis lateralibus inconspicuis, subtus in costa elevata pilosella ceterum glabra, nervis lateralibus multis immersis 6.5—9 cm longa, 2—2.5 cm lata, *folia apicem caulis versus* decrescientia; *petioli* sparse piloselli 5—8 mm longi. *Flores* axillares 3—7 aggregati in pedunculo longiuscule et sparse piloso 1—3 mm longo; *bracteae* (?) 2, lanceolatae extus pilosae circa 1 mm longae; *calycis lacinae* anguste ovato-triangularae obtusiusculae ciliatae ceterum subglabrae vel sparse pilosellae 1.5 mm longae; *tubus corollinus* anguste cylindricus apice leviter ventricosus glaber 6 mm longae; *antherae* oblongae basi subcordatae acutiusculae 1.5 mm longae; *ovarium*, apice glabro excepto, pilosum; *stylus* filiformis glaber 4.5 mm longus; *bacca* oblonga basi obtusa vel acutiuscula abrupte stipiti-formiter attenuata, apice rotundata styli rudimento coronata, primo sparse pilosa demum subglaber 12—16 mm longa, pedicello 2 mm longo.

Java, Western part, Mt. Pangerango: *van Hasselt* s.n. (L), fr. July. Locality unknown: *Blume* s.n. (L), type spec.; *van Hasselt* s.n. (L), fl. Apr.

***Alyxia winckeli*** Bakh.f., spec. nov.

*Scandens*; *ramuli* acute vel obtuse sed manifeste quadrangulares glabra vulgo verrucosa; *folia* 4-verticillata obovata vel ovato-oblonga, basi cuneata in petiolos attenuata, ex apice late obtuso-rotundato brevissime obtuso-acuminata, crassissima utrinque glabra, nervis lateralibus multis valde inconspicuis percursa, costa in pagina inferiori valde elevata, 7—10 cm longa, 4—5 cm lata, petiolo anguste alato crasso glabro 1 cm longo. *Paniculae* axillares apice glomeruliforme contractae circa 10-flores, pedunculo quadrangulari sparse pilosello vel subglabro 4—6 mm longo; *bracteae* 4-verticillatae lineares extus sparse pilosellae 2—3 mm longae; *flores* mihi in alabastro solum visi, ex schedula adjecta in maturitate alba, ut alabastra fragrantae; *calycis lacinae* oblongae obtusiusculae ciliatae extus densiuscule pilosellae 2.5 mm longae; *tubus corollinus* anguste infundibuliformis extus glaber intus in parte ventricosus solum pilosellus; *stamina* in media parte ventricosa affixa; *antherae* oblongae basi subcordatae, apice attenuatae acutae; *stylus* filiformis glaber 5.5 mm longus; *fructus* ignoti.

Java, Western part, Preanger Regencies, Mt. Limes, S. of Tjibeber, forest, climbing up a Schima-tree, alt. 1000 m: *W. F. Winckel* 685 (L), type spec., fl. Oct., v.n. palasari; Tjidadap, forest, alt. 1000 m: *Bakhuizen van den Brink* 3963 (L), fl. May.

I have named this species in honour of the late Mr. W. F. Winckel.

***Kopsia fruticosa*** (Ker.) D. C., Prodr. 8 (1844) 352 — *Cerbera fruticosa* Ker. in Bot. Reg. (1819) t. 391.

This species seems rather variable, although to my knowledge, no closer attention has been paid to its variability. *Kopsia fruticosa*, a common garden plant in Java, differs from the wild Sumatran forms in having

the corolla tube somewhat shorter (3—3.75 cm long in dried material). *Kopsia vincaeflora* Bl., Bijdr. (1826) 1030, is closely allied to this species; it is stated to have been found wild on Mt. Salak (in Western part). This statement is unreliable for *Kopsia fruticosa* and its allies have never yet been found in a wild state in Java. The corolla tube of *Kopsia vincaeflora* is distinctly longer, in dried material 4—4.5 cm long. The flowers are, with the exception of the red throat, white, contrarely to *K. fruticosa* which has pink or wholly white flowers.

***Kopsia pruniformis*** Reichb. f. et Zoll. ex Bakh. f., spec. nov. — *Kopsia pruniformis* Reichb. f. et Zoll. in Teysmann et Binnendijk, Cat. (1866) 125, nomen nudum — *Kopsia flavida*, apud auct. div., non Blume, quoad specimina javana.

*Arbor* usque ad 9 m altus; *ramuli* glabri; *folia* oblongo-lanceolata, basi acuta apice sensim attenuata, acuminata acumine rotundato, glabra coriacea, nervis lateralibus multis tenuibus marginem vix attingentibus, anastomosantibus, 13—21 cm longa, 5—8 cm lata, petiolo lato glabro 5—7.5 mm longo. *Flores* in cymas densas glabras 1—3 cm longas, 5-meri, pedunculo usque ad 1.5 cm longo; *bracteae* minutae longiuscule ciliatae; pedicelli 2 mm longi; *calycis* *lacinae* ovatae, acutiusculae vel obtusiusculae ciliatae ceterum glabrae 1.5—2 mm longae; *corolla* hypocrateriformis, ex Hasskarl inodora alba; tubus corollinus sub apice ventricosus extus glaber, intus a medio usque ad fauces sparse pilosae 2.5—3 cm longus; fauces incrassatae pilosae luteae, lacinae oblongae obtusae ciliatae intus pilis minutis dense obsitae; *filamenta* brevissima glabra; antherae ovato-oblongae acutae 2 mm longae; discus e squamulis 2 linearibus efformatus, ovario 1.5—2 × longior; *ovarium* glabrum; *stylus* glaber 2 cm longus; *drupa* oblonga basi apiceque obtusa glabra extus venulis elevatis notata, 2.5 cm longa.

Java, Eastern part, Rogodjampi: Zollinger 3832 (L), type spec.; Djember: Koorders 119β and 29975β (L), fl. March; Tangkil, alt. 200—300 m: Koorders 23441β (L), fl. June; Poeger: Koorders 119β and 121β (L), fl. March.

Bali, Branbang, alt. 52 m: Sarip 14 (L), fr. July.

This species has been confused by Hasskarl [Retzia I (1855) 44] with *Kopsia flavida* Bl. from New Guinea, which differs by its glabrous corolla lobes and by having the disc lobes as long as the ovary. According to Markgraf in Engl. Bot. Jahrb. 61 (1927) 196. Blume's species does not belong to *Kopsia*, but is possibly identical with *Kentrochrosia monocarpa* Lauterb. et K. Schum.

### **Parsonsia R. Br.**

The Javanese species are insufficiently known and there is apparently much confusion. At least 4 species occur in Java, but owing to scanty material and confused data in literature, I am not quite sure that the specific epithets are right.

***Parsonsia spiralis*** Wall. ex G. Don, Gen. Syst. 4 (1837) 80.

Since Blume the plant has never been recollected in Java. Its occurrence in Java needs confirmation. According to Pichon, in litt., *P. spiralis* should bear the name of *P. laevigata* (Moon) Alston (in Ann. Roy. Bot. Gard. Peradenya 11 (1929) 203).

***Parsonsia korthalsiana*** (Miq.) Boerl., Handl. Fl. Ned. Ind. 2<sup>2</sup> (1899)

397 — *Helygme korthalsiana* Miq., Fl. Ind. bat. 2<sup>1</sup> (1856) 429; Hallier f.



in Meded. Rijksherb. Leiden (1911) 27 — *Helygia javanica* Bl., Bijdr. (1826) 1043, non *Parsonsia javanica* Bl., Bijdr. (1826) 1041 — *Parsonsia spiralis*, apud auct. div., non G. Don, quoad specimina javana.

Java, Western part, Mt. Salak: *Blume* s.n. (L). Central part, Ngarengan, alt. 50 m: *Koorders* 37237 $\beta$  (L), fr. May, v.n. ojed wolar waliran; idem: *idem* 32114 $\beta$  (L), ster.

Sumatra, exact locality unknown: *Korthals* s.n. (U), type spec. of *Helygme korthalsiana* Miq., dupl. in L.

Much old Javan material is present in the Leyden Herbarium.

With some doubt I refer a sterile specimen from Central Java to this species.

***Parsonsia oblonga*** Wall. ex G. Don, Gen. Syst. 4 (1837) 80.

Java, Western part, Tjioamas near Buitenzorg: *Boerlage* s.n. (L), fl. Oct.

New for Java.

***Grisseea*** Bakh. f., genus novum, e Echitoideae-Parsonsieae.

*Scandens*; *folia* opposita penninervia; *cymae* axillares in inflorescentias umbelliformes vel paniculiformes aggregatae; *flores* 5-meri parvi; *calyx* anguste campanulatus, basi glandulis parvis multis munitus, alte 5-fidus; *laciniae* ovato-oblongae; *corolla* late campanulata; *tubus* in parte medio leviter ventricosus; *fauces* acervis pilorum penicilliformibus oppositipetalis, os tubi corollini praecludentibus munitae; *petala* in alabastro anguste dextrorsum obtegentia; *stamina* 5, paulum supra basin tubi corollini affixa; *filamenta* parum contorta, brevissime pilosella; *antherae* sagittatae *fauces* paulum excedentes, cum stigmate cohaerentes; *loculi* basi appendicibus sterilibus muniti; *discus* e lobis 5 efformatus; *ovarium* glabrum perfecte vel imperfecte 2-loculatum, ~-ovulatum; *stylus* filiformis glaber; *stigma* fusiforme basi membrana annulari parva instructum; *fructus* ignoti.

***Grisseea apiculata*** Bakh. f., spec. nov.

*Ramuli* dense piloselli; *folia* ovalia vel late oblonga basi rotundata vel obtuso, ex apice late rotundato brevissime apiculata herbacea supra glabra subtus in nervis pilosella ceterum glabra, nervis lateralibus 6—8, 7.5—13 cm longa, 5—8 cm lata, petiolo appresse pilosello 1.5—3 cm longo. *Inflorescentiae* pilis brevibus patentibus obsitae, breviter ramosae rami 2—5  $\times$  furcati, pedunculo 3—4.5 cm longo; *pedicelli* piloselli 1.5—2 mm longi; *calycis* *laciniae* acutiusculae apice recurvae extus breviter et densiuscule pilosae, margine translucidae, intus apice pilosellae basin versus demum glabrae; *calycis* *glandulae* triangulares; *corolla* 4.5 mm longa, extus densiuscule pilis brevibus obsita, ad medium fissa; *tubus* corollinus intus supra medium dense pilis longiusculis deflexis munitus, 2.5 mm longus; *lobi* ovati acuti 2 mm longi; *filamenta* 0.5—0.8 mm longa; *antherae* 2 mm longae; *disco* squamuli ovati vel ovato-triangulares emarginati vel bidentati 1 mm longi; *stylus* 1.5 mm longus.

Java, Eastern part, Grissee, below 100 m alt., brushwood on calcareous soil: *Dorgelo* 2022 (BZ), type spec., fl. Aug.

The generic name has been derived from Grissee, a village N. of Soerabaja in East Java. *Grisseea* is related with *Parsonsia*, differing, however, in the following characters; corolla throat below each petal with a tuft of dense long hairs, which preclude the entrance to the tube; stamens inserted somewhat above the base of the corolla tube, filaments

slightly twisted. In *Parsonsia* contrariwise the throat bears no appendages, the filaments are inserted half way up the corolla tube and the filaments are strongly twisted.

**Alstonia** R. Br. in Mem. Wern. Soc. 1 (1809) 75, nomen conservandum; Pichon in Bull. Mus. Paris sér. II, 19, nr. 3 (1947) 294—301.

According to Mr. Pichon *Alstonia angustiloba* Miq. represents the type of a distinct genus, *Paladelphina* Pichon in l. c. (1947) 299, characterized by its remarkable anthers, pollen and ovary.

**Blaberopus** DC., Prodr. 8 (1844) 410; Pichon in Bull. Mus. Paris sér. II, 19, nr 3 (1947) 300, 301.

**Blaberopus sericeus** (Bl.) DC, l. c. (1844) 411 — *Alstonia sericea* Bl., Bijdr. (1826) 1038.

This remarkable species, a true *Blaberopus* and certainly not an *Alstonia*, is said to occur in Western Java on Mt. Salak. Since Blume recorded the plant for Java it has not been recollected in the island. It is doubtful whether Blume's statement is correct. The nearest affinity of *Blaberopus sericeus* is with *Bl. neriifolius* (D. Don) DC, differing by broader leaves, but the conspicuous habit is nearly the same.

**Wrightia calycina** A. DC., Prodr. 8 (1844) 405; Backer, Onkruidfl. Java Suiker (1931) 501, 502; Tsiang in Sunyatsenia 4<sup>1-2</sup> (June 1939) 52, 53.

**Wrightia javanica** A. DC, Prodr. 8 (1844) 405; Heyne, De Nutt. Pl. Ned. Ind. ed. 2, 2 (1927) 1292; Backer, Onkruidfl. Java Suiker (1931) 500, 501; Tsiang in Sunyatsenia 4<sup>1-2</sup> (June 1939) 50—52, t. 12.

**Wrightia pubescens** R. Br. in Mem. Wern. Soc. 1 (1809) 73; Heyne, De Nutt. Pl. Ned. Ind. ed. 2, 2 (1927) 1292; Backer, Onkruidfl. Java Suiker (1931) 501; Tsiang in Sunyatsenia 4<sup>1-2</sup> (June 1939) 49, t. 15.

**Wrightia religiosa** (T. et B.) Benth. et Hook., Gen. Pl. 2 (1876) 713; Tsiang in Sunyatsenia 4<sup>1-2</sup> (June 1939) 42, 43 — *Echites religiosa* T. et B. in Tijdschr. Ned. Ind. 27 (1864) 34.

**Physetobasis** Hassk. in Flora (1857, non 1847) 104.

Monotypic: **Ph. macrocarpa** Hassk. in l. c. 104 [*Holarrhena macrocarpa* (Hassk.) Villar in Blanco, Fl. Philipp. 4 (non 3), Nov. App. (1880) 130].

This genus has been a source of confusion. Posterior to Hasskarl the type specimen (which may be preserved in the Buitenzorg Herbarium) has not been re-examined not even by Bentham and Hooker. The latter even did not succeed in having the original description. This failure was due to the incorrect citation of the year of publication.

**Roupellia grata** Benth. — *Strophantus gratus* (Benth.) Baill. Cf. H. J. Toxopeus in Meded. Alg. Proefst. Landb. 74 (1948) 1—22; F. de Wit in Landbouw 13 (1948) 98—105.

### Orobanchaceae, fam. CXCHII.

Backer, Onkruidfl. Java Suiker (1931) 631—632.

**Aeginetia mirabilis** (Bl.) Bakh. in De Trop. Nat. 10 (1921) 172, fig. 3, 6, 10; Bakhuizen van den Brink in Bull. Jard. Bot. Buitenzorg sér. III, 131 (Dec. 1939) 84, fig. 2 — *Aeginetia mirabilis* (Bl.) Livera in Ann. Roy. Bot. Gard. Perad. 10<sup>2</sup> (1927) 150, 155 — *Centronia mirabilis* Bl., Bijdr. (1826) 776, 777.

## Gesneriaceae, nom-conserv., fam. CXC.V.

Koorders, Fl. v. Tjibodas 3 (1918) 108—125; Hochreutiner in Candollea 2 (1924—1926) 210—223.

**Didymocarpus asperifolia** (Bl.) Bakh.f., comb. nov. — *Agalmyla asperifolia* (Bl.) Miq., Fl. Ind. bat. 2 (1856) 733 — *Busea* ? *asperifolia* (Bl.) Miq., Fl. Ind. bat. 2 (1856) 733 — *Dichrotrichum asperifolium* (Bl.) Benth. et Hook.f. ex Clarke in D C, Monogr. Phaner. 5 (1883—1887) 54 — *Tetradema asperifolium* (Bl.) Schltr. in Notiz bl. Bot. Gart. Berlin 7 (1920) 361 — *Tromsdorffia speciosa* Bl., Bijdr. (1826) 763 — *Chirita blumei* Clarke in D C, Monogr. Phaner. 5 (1883—1887) 122 — *Begonia oligophylla* Miq., Fl. Ind. bat. 1<sup>a</sup> (1855) 692, quod est stadium juvenile — *Didymocarpus barbata* Jack. in errore apud Beumée in De Trop. Nat. 14 (1925) 92, 93, fig. 3.

**Didymocarpus zollingeri** (Clarke) O. K. var. **cyathiflora** Bakh. f., var. nov. — *Chirita coerulea* R. Br. in Benn., Pl. Jav. rar. (1838—1852) 117 and in Ann. Sci. Nat. sér. II, 13 (1840) 162 — *Didymocarpus coerulea* (R. Br.) Kds., Exk. Fl. Java 3 (1912) 189, non *Didymocarpus coerulea* Ridley in Journ. Linn. Soc. 3211 (1896) 513 — *Didymocarpus cyathiflora* Reichb. f. et Zoll. in Teysmann et Binnendijk, Cat. (1866) 156, nomen nudum.

**Didymocarpus zollingeri** (Clarke) O. K., Rev. Gen. (1891) 477 — *Didymocarpus zollingeri* (Clarke) Kds., Exk. Fl. Java 3 (1912) 190 — *Chirita zollingeri* Clarke in D C, Monogr. Phaner. 5 (1883—1887) 125.

**Didymocarpus horsfieldii** (R. Br.) O. K. ex Kds., Exk. Fl. Java 3 (1912) 190 — *Chirita horsfieldii* R. Br. in Benn., Pl. Jav. rar. (1838—1852) 117 — *Didymocarpus barbata*, apud auct. div., non Jack. in Trans. Linn. Soc. 14 (1823) 38.

**Didissandra** Clarke in D C, Monogr. Phaner. 5 (1883—1887) 65, antedated by the monotypic genus *Ellobum* Bl., Bijdr. (1826) 746, has been proposed for enlistment in the nomina conservanda by Dr C. G. G. J. van Steenis in Flora Malesiana Bull. 3 (Apr. 1948) 72, 73.

**Didissandra montana** (Bl.) Bakh.f. in Fl. Mal. Bull. (1948) 73 — *Ellobum montanum* Bl., Bijdr. (1826) 747 — *Vandellia ellobum* (Bl.) Benth. in D C, Prodr. 10 (1846) 417; Miquel, Fl. Ind. bat. 1<sup>a</sup> (1857) 694 — *Lobelia ellobum* (Bl.) Kds., Exk. Fl. Java (1912) 179; *Didymocarpus reptans*, in errore apud Beumée in De Trop. Nat. 8 (1919) 62, fig. 9, non Jack.

**Rhynchothecum** (sphalm. *Rhynchotechum*) **eximium** (Clarke) Schltr. in Engl. Bot. Jahrb. 58 (1923) 303 — *Isanthera eximia* Clarke in D C, Monogr. Phaner. 5 (1883—1887) 193.

I wholly agree with Schlechter, that Clarke's species belongs to *Rhynchothecum*. The type specimen is reserved in the Utrecht Herbarium, a duplicate is present at Leyden.

**Stauranthera coerulea** (Bl.) Merr., Enum. Philipp. Pl. 3 (1923) 455 — *Miquelia coerulea* Bl. in Bull. Sc. Phys. et Nat. Néerl. 1 (1838) 94 — *Stauranthera ecalcarata* R. Br. in Benn., Pl. Jav. rar. (1838—1852) 121 — *Miquelia azurea* Bl. in Rumphia 4 (1848) 34.

**Monophyllaea horsfieldii** R. Br. in Benn., Pl. Jav. rar. (1838—1852)



183 — *Monophyllaea pygmaea* Clarke in D C, Monogr. Phaner. 5 (1883—1887) 183.

**Epithema horsfieldii** (R. Br.) R. Br. ex D C, Prodr. 9 (1845) 279 — *Aikinia horsfieldii* R. Br. in Wall., Pl. As. rar. 3 (1832) 66 — *Epithema difforme* Span. in Linnaea 15 (1841) 331 — *Argostemma ? begoniaceum* Miq., Fl. Ind. bat. 2 (1856) 348.

De Candolle and later the Kew Index erroneously ascribed the combination *E. horsfieldii* to "R. Brown in Wall."

**Loxonia hirsuta** Jack in Trans. Linn. Soc. 14 (1823) 40 — *Loxonia acuminata* R. Br. in Benn., Pl. Jav. rar. (1838—1852) 105, t. 25. *Loxonia discolor* Jack in l.c. (1823) 40 probably belongs to this species, which is rather variable as to the indumentum and the colour of the young leaves, which vary from green to purple. The flowers on the contrary show no important differences.

**Aeschynanthus** Jack in Trans. Linn. Soc. 14 (1823) 42, nom. cons.; pro synonymis specierum sequentium vide etiam sub *Trichosporum* D. Don [in Edinb. Phil. Journ. 7 (1882) 84, nom. rejic.].

**Aeschynanthus albidus** (Bl.) Steud., Nom. ed. 2, I (1840) 32; D C. Prodr. 9 (1845) 262; Doeters van Leeuwen in De Trop. Nat. 18 (1928) 62, 131 — *Bignonia albida* Bl., Cat. (1823) 82, descr. — *Aeschynanthus purpurascens* Hassk., Cat. Bog. 2 (1844) 154.

**Aeschynanthus angustifolia** (Bl.) Steud., Nom. ed. 2, 1 (1840) 32 — Doeters van Leeuwen in De Trop. Nat. 18 (1928) 60, 62, 132 — *Bignonia angustifolia* Bl., Cat. (1823) 82, descr.

**Aeschynanthus horsfieldii** R. Br. in Benn., Pl. Jav. rar. (1838—1852) 116; De Candolle, Prodr. 9 (1845) 262, in eo opere R. Brown citatus — *Aeschynanthus rubiginosa* T. et B. in Nat. Tijdschr. Ned. Ind. 25. sér. V, 5 (1863) 413.

**Aeschynanthus horsfieldii** R. Br. var. **geminata** (Z. et M.) Bakh. f., comb. nov. — *Aeschynanthus geminata* Z. et M. in Nat. en Geneesk. Arch. Neerl. Ind. 2 (1845) 574.

**Aeschynanthus radicans** Jack in Trans. Linn. Soc. 14 (1823) 43.

I reduce the following to this extremely variable species: *Aeschynanthus boschianus* De Vriese in Tijdschr. Nat. Gesch. 2 (1835) 341; idem in Ann. Soc. Agr. et Bot. Gand. 1 (1845) 403 — *Aeschynanthus intermedius* T. et B. in Nat. Tijdschr. Ned. Ind. 25 ser. V, 5 (1863) 414 — *Aeschynanthus javanica* Rollins in Hook. Bot. Mag. (March 1850) t. 4503 — *Aeschynanthus lamponga* Miq., Fl. Ind. bat. (1862) Suppl. Sumatra, 563 — *Aeschynanthus miniata* Lindley in Bot. Reg. N. S., 19 (1896) t. 61, nomen confusum — *Aeschynanthus neesii* Z. et M., Verz. Ind. Arch. (1854) 56 — *Aeschynanthus pulchra* G. Don, Gen. Syst. 4 (1838) 656 — *Aeschynanthus teysmanniana* Miq. in Bot. Zeit. (1848) 509 — *Aeschynanthus zollingeri* Clarke in D C, Monogr. Phaner. 5 (1883—1887) 44.

**Aeschynanthus volubilis** Jack in Trans. Linn. Soc. 14 (1823) 42, t. 2, fig. 3 — *Aeschynanthus obovata* Clarke var. ? *pallida* Clarke in D C, Monogr. Phaner. 5 (1883—1887) 48.

**Cyrtandra aurea** Jack in Trans. Linn. Soc. 14 (1823) 29 — an? *Cyrtandra cordifolia* de Vriese, Pl. Ind. bat. Reinw. (1856—1857), non Gaudichaud (1826).

**Cyrtandra calyptribracteata** Bakh. f., spec. nov. — *Cyrtandra cuneata*, auct. div., non Blume, Bijdr. (1826) 773.

*Frutex* vel *arbuscula* 2—5 m altus; *ramuli* subquadrangulares, non sulcati, in partibus apicalibus ultimis densiuscule breviter fusco-pilosi, deorsum glabri; *folia* ejusdem paris subaequalia oblonga-lanceolata vel elliptica vel obovata, basi acuta vulgo aequilateralia, apice breviter acute acuminata leviter laxe dentata, supra praecipue in costa sparse pilosella, subtus in nervis dense pilosella, inter nervos non vel vix pilosella, in utroque parte costae nervis lateralibus 9—11 pereursa, inconspicue laxe venosa, 11—30 cm longa, 4—10 cm lata; petioli graciles dense piloselli 1—5 cm longi; *bracteae* ovatae calyptriformes inflorescentias juveniles includentes, longe acute acuminatae, postea fissae, extus sparse pilosellae, intus dense et longe pilosae, 1—1.8 cm longae; *flores* in axillis foliorum persistentium, in umbellae paucifloras dispositi; pedunculi piloselli 1—3 cm longi; pedicelli dense pilosi 0.5—1 cm longi; *calyx* campanulatus extus densiuscule appresse pilosellus 6—10 mm longus; laciniae late ovato-triangulares acuminatae 2—4 mm longae; *corolla* primo extus pilosella, postea glabriuscula, sordide rubra rosea vel alba circa 1.5 cm longa, laciniis brevibus; *stamina* circa in medio tubo corollae affixa; filamenta glabra 3 mm longa; antherae 1.5 mm longae; staminodia (?) 3, antheris valde reductis, circa 1 mm longae; discus annularis glaber 2 mm altus; *ovarium* glabrum; stylus apice glanduloso-pilosus longe persistens, stigmate bilobo; *bacca* oblonga vel obovoidea glabra 1 cm longa.

Java, Western part, Preanger Regencies, Tjigenteng, forest, alt. 1400—1600 m: *Koorders* 26344  $\beta$  (L), fl. fr. Jan.; Central part, Mt. Telemojo: *Koorders* 29674  $\beta$  (L), fr. Febr.; idem, alt. 1400 m: *Koorders* 35819  $\beta$  (L), fl. May; idem, alt. 1200 m: *Koorders* 39227  $\beta$  (L), fr. Apr.; Koekoesan, near Mt. Lawoe, alt. 1500—1700 m: *J. Elbert* 124 (L), ster.; Sarangan, near Mt. Lawoe, forest, alt. 1000 m: *J. D. Dorgelo* s.n. (L), fr. Aug.; idem: *n.v.* s.n. (L), type spec., fl. fr. Oct., sub H. L. B. 945. 316—64; Mt. Lawoe, S.E. slope: *J. Elbert* 123 (L), fr. Nov.; Sigogor: *Koorders* 29243  $\beta$  (L), fr. Aug.; Soerakarta, Tawang mangoe, alt. 1300 m: *R. Brinkman* 809 (L), fl. fr. July; Eastern part, Ranoe Daroengan, S. slope of Mt. Smeroe, forest, alt. 1600 m: *Backer* 36433 (L), fr. June; Tosari: *J. D. Kobus* s.n. (L); Tjoeramanis: *Koorders* 21001  $\beta$  (L), fr. Sept.; Kletak, forest, alt. 1600 m: *J. P. Mousset* 661 (L), fr. June; path Smerochoeve to Sendocera, alt. 1500 m: *van Steenis* 7316 (L), fr. June; Kali bendo, alt. 800 m: *Koorders* 43228  $\beta$  (L), fr. July. Locality unknown: *Waltz* s.n. (L); *Jung-huhn* s.n. (L).

**Cyrtandra elbertii** Bakh. f., spec. nov.

An ? *frutex*; *ramuli* teretiuseculi subsulcati, in partibus apicalibus ultimis dense pilosi, deorsum glaberrimi; innovationes dense et longe aureo-pilosi; *folia* ejusdem paris aequalia obovata basi (?) vulgo aequilateralia acuta, ex apice lato breviuscule acute acuminata coriacea integra supra glabra, subtus in nervis dense appresse pilosae, inter nervos sparsissime piloselli, in utroque parte costae, nervis lateralibus 8—10 pereursa, evenia 11—13 cm longa, 4.5—6 cm lata; petioli glabri 8—12 mm longi; *flores* in axillis foliorum persistentium in cymas sessiles digesti; *bracteae* mihi ignotae probabiliter mox deciduae ac parvae; pedicelli tenues glabri circa 1 cm longi; *calyx* campanulatus glaber 7—8 mm longus; laciniae late ovato-triangulares acuminatae 4—5 mm longae; *corolla* ignota; discus annularis glaber; *bacca* oblonga glabra 16 mm longa (styli basi 4 mm longo computato).

Java, Central part, Koekoesan near Mt. Lawoe, forest, alt. 1500—1700 m: *J. Elbert* 126 (L), type spec., fl. Nov.

***Cyrtandra grandis*** Bl. var. ***ampla*** (Clarke) Bakh. f., comb. nov. — *Cyrtandra ampla* Clarke in D C, Monogr. Phaner. 5 (1883—1887) 259.

***Cyrtandra grandis*** Bl. var. ***rubra*** (de Vriese) Bakh. f., comb. nov. — *Cyrtandra rubra* De Vriese, Pl. Ind. bat. Reinw. (1856—1857) 16.

***Cyrtandra nemorosa*** Bl., Bijdr. (1826) 771 — *Cyrtandra reticosa* Clarke in D C, Monogr. Phaner. 5 (1883—1887) 212.

***Cyrtandra nemorosa*** Bl. var. ***heterophylla*** (De Vriese) Bakh. f., comb. nov. — *Cyrtandra heterophylla* De Vriese, Pl. Ind. bat. Reinw. (1856—1857) 15.

***Cyrtandra pendula*** Bl.

The length of the peduncles is very variable. Three classes of dimensions can be distinguished, between which no transitions have been found, viz:

var. *genuina* Hochr. in Candollea 5 (1931—1934) 221.

Peduncle 10—28 cm long.

var. *blumeana* Clarke in D C, Monogr. Phaner. 5 (1883—1887) 242.

Peduncle 3.5—7 cm long.

var. *subsessilis* Bakh. f.

Peduncle only 0.5 cm long.

***Cyrtandra pendula*** Bl. var. ***subsessilis*** Bakh. f. var. nov.

Differt a typo pedunculo circa 5 mm longo et statura graciliore.

Java, without locality: *Blume* 1717 (L), type spec., sub nomine *Rhynchosarpus pallidus* Bl.

Clarke identified this plant with *Cyrtandra humilis* Bl., but nothing supports this view, neither the description, nor the locality, nor the name in the schedula, although with regard to the latter the word “humilis” was written by Blume probably posteriorely above the word “pallidus”.

***Cyrtandra picta*** Bl., Bijdr. (1826) 769; Hochreutiner in Candollea 5 (1931—1934) 221 — *Cyrtandra longepetiolata* De Vriese, Pl. Ind. bat. Reinw. (1856—1857) 12.

***Cyrtandra picta*** Bl. var. ***repens*** (de Vriese) Bakh. f., comb. nov. — *Cyrtandra repens* De Vriese, Pl. Ind. bat. Reinw. (1856—1857) 14 — an? *Cyrtandra humilis* Bl., Bijdr. (1826) 769.

I could not trace Blume's type specimen in the Leyden herbarium. Blume's nr. 210, vide Clarke in l. c. (1883—1887) 245, is not the type.

***Cyrtandra populifolia*** Miq., Fl. Ind. bat. 2 (1857) 741 — an? *Cyrtandra arborescens* Bl., Bijdr. (1826) 773, non De Vriese (1856—1857).

Blume's type specimen could not be traced by me in the Leyden herbarium.

***Cyrtandra reinwardtii*** (Clarke) Bakh. f. comb. nov. — *Cyrtandra populifolia* Miq. var. *reinwardtii* Clarke in D C, Monogr. Phaner. 5 (1883—1887) 262 — *Cyrtandra glabra* Jack in errore apud Blume, Bijdr. (1826) 768.

***Cyrtandra rostrata*** Bl. var. ***sericea*** Bakh. f., var. nov.

Differt a typo characteribus sequentibus: innovationes, inflorescentiae, calyces, paginae inferiores foliorum et petioli appresse fulvo-pilosi; folia



obliqua late lanceolata crasse coriacea 15—28 cm longa, 5—10 cm lata; petioli 1—3 cm longi.

Pedunculi apicem versus leviter sed distincte elati crassi 7—12 mm longi; bracteae oblongo-lanceolatae 13—20 mm longae, 4—5 mm latae; pedicelli 4—8 mm longi; calyx dense et longe sericeus 6—11 mm altus; lacinae 3—6 mm longae; corolla alba 8—10 mm longa; stylus circa 2 mm longus; bacea circa 13 mm long.

Java, Western part, Batavia, Mt. Salak, alt. 800 m: *Koorders* 24231  $\beta$  (L), fl. Sept., v.n. khamperoe bogor; Preanger Regencies, Tjadasmalang, S.W. of Tjibeber, alt. 1000 m: *W. F. Winkel* 1455  $\beta$  (L), type spec., fl. fr. Aug., v.n. kibasah; idem, alt. 900 m: *Backer* 22899 (L), ster.; G. Beser, S.W. of Tjibeber, alt. 1000 m: *J. J. Smith* 741 (L), fl. fr. June; Tjampaka, S.W. of Tjibeber, alt. 1000 m: *J. J. Smith* 811 (L), fl. June; Tjikao: *Korthals* s.n. (L); Bantam, Artja: *Kuhl and van Hasselt* s.n. (L). Locality unknown: *Junghuhn* s.n. (L); *Reinwardt* s.n. (L).

***Cyrtandra rufa*** Bakh. f., nom. nov. — *Whitia carnosa* Bl., Bijdr. (1826) 775, excl. syn., non *Cyrtandra carnosa* Jack in Trans. Linn. Soc. 14 (1823) 50.

Java, Western part, Batavia, Mt. Moenara: *Reinwardt* s.n. (L), type spec. and lectotype of *Whitia carnosa* Bl., sub H. L. B. 903. 307—406, 467; Mt. Pangerango: *Kuhl and van Hasselt* s.n. (L).

Borneo, without exact locality: *Korthals* s.n. (L).

I could not trace Blume's original specimen, from Mt. Seriboe in the Leyden Herbarium, but in my opinion Blume's description and the Javanese specimen doubtless cover each other. *Cyrtandra carnosa* Jack differs e.g. by its unilateral disc.

### Commelinaceae, fam. CCXI.

*Koorders*, Fl. v. Tjibodas 1 (1918) 38—42; *Hochreutiner* in *Candollea* 2 (1924—1926) 319—324; *Ochse*, Indische groenten (1931) 108—118; *Backer*, Handboek Flora Java 3 (1924) 18—39; idem, Onkruidfl. Java Suiker (1928) 178—185.

***Aneilema blumei*** (Hassk.) Bakh. f., comb. nov. — *Dichaespermum blumei* Hassk., Comm. (1870) 41 — *Aneilema hamiltonianum* Wall. ex Clarke in DC, Monogr. Phaner. 3 (1881) 213; *Backer*, Onkruidfl. Java Suiker (1928) 183 — *Aneilema hamiltonianum* Wall. ex Kunth, Enum. 4 (1843) 74, nomen nudum.

***Aneilema giganteum*** (Vahl) R. Br., Prodr. (1810) 271; van Steenis in De Trop. Nat. (1936), Jubil. Uitg., 112, 120, hollandice — *Commelina gigantea* Vahl, Enum. 2 (1806) 177.

***Aneilema herbaceum*** (Roxb.) Wall. ex Kunth, Enum. 4 (1843) 66 — *Aneilema herbaceum* Wall. ex Clarke in DC, Monogr. Phaner. 3 (1881) 204 — *Commelina herbacea* Roxb., Fl. Ind. ed. Wall., 1 (1820) 175.

***Aneilema monadelphum*** (Bl.) Kunth, Enum. 4 (1843) 64, sub *Anilema*; *Hochreutiner* in *Candollea* 2 (1924—1926) 322 — *Aneilema monadelphum* R. Br. ex Kunth, in errore in Index kewensis — *Commelina monodelpha* Bl., Enum. (1827) 4.

***Aneilema nudiflorum*** R. Br., Prodr. (1810) 271; *Backer*, Onkruidfl. Java Suiker (1934) 182 — *Commelina minuta* Bl., Cat. (1823) 34, descr.

***Aneilema ovatum*** (Hassk.) Wall. ex Clarke in DC, Monogr. Phaner. 3 (1881) 218 — *Aneilema ovatum* Wall. ex Kunth, Enum. 4 (1843) 73,

nomen nudum — *Dictyospermum ovatum* Hassk., Commel. (1870) 24 — *Dictyospermum wightii* Hassk., Comm. (1870) 19.

*Aneilema scaberrimum* (Bl.) Kunth, Enum. 4 (1843) 69 — *Commelina scaberrima* Bl., Enum. (1827) 4 — *Aneilema protensum* Wall. ex Clarke in DC, Monogr. Phaner. 3 (1881) 219.

*Aneilema spiratum* (L.) R. Br. ex Clarke in DC, Monogr. Phaner. 3 (1881) 207; Hochreutiner in Candollea 2 (1924—1926) 321; Backer, Onkruidfl. Java Suiker (1928) 182 — *Commelina spirata* L., Mant. 2 (1771) 176.

*Commelina benghalensis* L., Spec. Pl. 1 (1753) 41; Hochreutiner in Candollea 2 (1924—1926) 319; Backer, Onkruidfl. Java Suiker (1928) 179.

*Commelina nudiflora* L., Spec. Pl. 1 (1753) 41; Hochreutiner in Candollea 2 (1924—1926); Backer, Onkruidfl. Java Suiker (1928) 180 — *Commelina oligotricha* Miq., Fl. Ind. bat. 3 (1855) 532; Clarke in DC, Monogr. Phaner. 3 (1881) 191.

*Commelina paludosa* Bl., Enum. (1827) 2 — *Commelina obliqua* Buch. — Ham. ex D. Don, Prodr. Fl. Nep. (1825) 45, non Vahl, Enum. 2 (1806) 173; Hochreutiner in Candollea 2 (1924—1926) 320.

*Commelina subfruticosa* Bl., Cat. (1823) 35, descr. — *Commelina suffruticosa* Bl., Enum. (1827) 3.

*Cyanotis axillaris* (L.) D. Don, Prodr. Fl. Nep. (1825) 46; R. et S., Syst. Veg. 7<sup>2</sup> (1830) 1154; Backer, Onkruidfl. Java Suiker (1928) 185 — *Commelina axillaris* L., Spec. Pl. 1 (1753) 62; Burman f., Fl. Ind. (1768) 17.

*Cyanotis ciliata* (Bl.) Bakh.f. comb. nov. — *Tradescantia ciliata* Bl., Cat. (1823) 61, descr. — *Tradescantia capitata* Bl., Enum. (1827) 6 — *Cyanotis capitata* (Bl.) Clarke in DC, Monogr. Phaner. 3 (1881) 243; Hochreutiner in Candollea 2 (1924—1926) 323.

*Cyanotis cristata* (L.) D. Don, Prodr. Fl. Nep. (1825) 46; R. et S., Syst. Veg. 7<sup>2</sup> (1830) 1150; Hochreutiner in Candollea 2 (1924—1926) 324; Backer, Onkruidfl. Java Suiker (1928) 185 — *Commelina cristata* L., Spec. Pl. 1 (1753) 62 — *Cyanotis vaga* (Bl.) R. et S., Syst. Veg. 7<sup>2</sup> (1830) 1153; Miquel, Fl. Ind. bat. 3 (1855) 545.

*Cyanotis moluccana* (Roxb.) Merr. in Philipp. Journ. Sci. 2 (1907) 266; Koorders, Exk. Fl. Java 1 (1912) 282 — *Commelina moluccana* Roxb., Fl. Ind. 1 (1820) 172 — *Cyanotis uniflora* Hassk., Commel. (1870) 104.

*Pollia secundiflora* (Bl.) Bakh.f., comb. nov. — *Commelina secundiflora* Bl., Enum. (1827) 5 — *Pollia elegans* Hassk. in Pl. Jungh. (1851—1855) 149 — *Aclisia sorzogonensis* E. Mey in Presl., Reliq. Haenk. 1 (1830) 138, t. 24 — *Pollia sorzogonensis* (E. Mey) Endl., Gen. (1836—1840) 1029; Steudel, Nom. ed. 2, 2 (1841) 368.

*Pollia thyrsoflora* (Bl.) Endl., Gen. (1836—1840) 1029; Hasskarl in Pl. Jungh. (1851—1855) 150 — *Tradescantia thyrsoflora* Bl., Enum. (1827) 6.

### Flagellariaceae, fam. CCXII.

*Hanguana malayana* (Jack) Merr. var. *anthelmintica* (Bl. ex R. et S.) Bakh.f., comb. nov. — *Susum anthelminticum* Bl. ex R. et S., Syst. Veg. 7 (1830) 1493 — *Susum malayanum* (Jack) Planch. ex Hook.f. var. *aquatica* Back., Handb. Fl. Java 3 (1924) 3.

## Smilacaceae, fam. CCXXIV.

*Heterosmilax micrantha* (Bl.) Bakh.f., comb. nov. — *Smilax micrantha* Bl., Enum. (1827) 18; Backer, Handb. Fl. Java 3 (1924) 80 — *Heterosmilax japonica* Kunth var. *javanica* DC, in Monogr. Phaner. 1 (1878) 43, based on Zollinger nr. 857.

*Smilax micrantha* Bl. up till now an insufficiently known species, appeared to belong to *Heterosmilax* Kunth. De Candolle who could not trace the type specimen in the Leyden Herbarium, stated in l.c. (1878) 43 "specimen floriferum javanicum, Blumei, in herb. Lugd. Bat. non inveni". However, the type specimen of *Smilax micrantha* Bl. does exist in the Leyden Herbarium, under H. L. B. 907.2 — 14.

## Index.

\* = new taxon; \*\* = nov. comb. and nom. nov.; synonyms in italics.

<i>Acanthostemma hasseltii</i> Bl. ....	379	<i>lucida</i> .....	389
<i>kühlii</i> Bl. ....	378	<i>reinwardti</i> Bl. ....	389
<i>longifolia</i> Bl. ....	378	** <i>reinwardti</i> Bl. var. <i>latifolia</i>	
<i>pictum</i> Bl. ....	379	(Bl.) Bakh. f. ....	390
<i>Aclisia sorzogonensis</i> E. Mey ....	399	<i>stellata</i> (Forst.) R. et S. ....	389
<i>Aeginetia mirabilis</i> (Bl.) Bakh. ....	393	<i>stellata</i> (Forst.) R. et S. var.	
<i>mirabilis</i> (Bl.) Livera ....	393	<i>latifolia</i> Bl. ....	390
<i>Aegiphila laevigata</i> Juss. ....	387	* <i>winckeli</i> Bakh. f. ....	389, 390
<i>Aeschynanthus</i> Jack .....	395	<i>Aneilema</i> ** <i>blumei</i> (Hassk.)	
<i>albidus</i> (Bl.) Steud. ....	395	Bakh.f. ....	398
<i>angustifolia</i> (Bl.) Steud. ....	395	<i>giganteum</i> (Vahl) R. Br. ....	398
<i>boschianus</i> de Vriese ....	395	<i>hamiltonianum</i> Wall. ex Kunth	398
<i>geminata</i> Z. et M. ....	395	<i>herbaceum</i> Wall. ex Clarke.....	398
<i>horsfieldii</i> R. Br. ....	395	<i>herbaceum</i> (Roxb.) Wall. ex	
** <i>horsfieldii</i> R. Br. var. <i>geminata</i>		Kunth .....	398
(Z. et M.) Bakh. f. ....	395	<i>monadelphum</i> (Bl.) Kunth ....	398
<i>intermedius</i> T. et B. ....	395	<i>nudiflorum</i> R. Br. ....	398
<i>javanica</i> Rollins ....	395	<i>ovatum</i> (Hassk.) Wall. ex	
<i>lamponga</i> Miq. ....	395	Clarke .....	398
<i>minata</i> Lindley ....	395	<i>protensum</i> Wall. ex Clarke ...	399
<i>neesii</i> Z. et M. ....	395	<i>spiratum</i> (L.) R. Br. ....	399
<i>obovata</i> Clarke var. ? <i>pallida</i>		<i>scaberrimum</i> (Bl.) Kunth ....	399
Clarke .....	395	<i>Anilema</i> .....	398
<i>pulchra</i> G. Don .....	395	<i>Anodendron tenuiflorum</i> Miq. ....	387
<i>purpurascens</i> Hassk. ....	395	Apocynaceae .....	384
<i>radicans</i> Jack .....	395	<i>Aralia aromatica</i> Bl. ....	367
<i>rubiginosa</i> T. et B. ....	395	** <i>dasyphylla</i> Miq. var. <i>urticifolia</i>	
<i>teysmanniana</i> Miq. ....	395	(Bl. ex Miq.) Bakh. f. ....	367
<i>volubilis</i> Jack .....	395	<i>ferox</i> Miq. ....	367
<i>zollingeri</i> Clarke .....	395	<i>lucescens</i> Bl. ....	368
<i>Agalmyla asperifolia</i> Bl. ....	394	* <i>montana</i> Bl. var. <i>crassifolia</i>	
<i>Aganosma blumei</i> DC .....	387	Bakh. f. ....	367
<i>euloba</i> Miq. ....	387	<i>pergamacea</i> Bl. ....	368
<i>velutina</i> DC. ....	387	<i>rigida</i> Bl. ....	368
<i>Aikinia horsfieldii</i> R. Br. ....	395	<i>urticifolia</i> Bl. ex Miq. ....	367
<i>Alstonia</i> R. Br. ....	393	Araliaceae .....	367
<i>angustiloba</i> Miq. ....	393	<i>Argostemma begoniaceum</i> Miq. ...	395
<i>sericea</i> Bl. ....	393	Asclepiadaceae .....	368
<i>Alyxia Banks</i> ex R. Br. ....	389	<i>Asclepias curassavica</i> L. ....	370
* <i>cinerea</i> Bakh. f. ....	389, 390	<i>tinctoria</i> Roxb. ....	374



<i>volubilis</i> L. f. ....	373	<i>fragrans</i> (Moon.) Alst. ....	388
<i>Asterostemma repandum</i> Decne ...	373	<i>macrophylla</i> (Roxb.) G. Don ...	388
<i>Atherandra</i> Bl. ....	369	<i>mollis</i> Miq. ....	388
<i>acuminata</i> Decne ....	369	<i>mollissima</i> Boerl. ....	388
<i>acutifolia</i> Decne ....	369	<i>penangensis</i> Ridley ....	389
<i>cuspidata</i> Bl. ....	369	<i>Citrus javanica</i> Bl. ....	366
<i>pubescens</i> Bl. ....	369	<i>medica</i> L. ....	366
<i>Atherostemon</i> Bl. ....	369	<i>Commelina axillaris</i> L. ....	399
<i>javenensis</i> Bl. ....	369	<i>benghalensis</i> L. ....	399
<i>Beaumontia grandiflora</i> Wall. ....	387	<i>cristata</i> L. ....	399
<i>hasianae</i> Hook. f. ....	387	<i>giganta</i> Vahl ....	398
<i>multiflora</i> T. et B. ....	387	<i>herbacea</i> Roxb. ....	398
<i>Begonia oligophylla</i> Miq. ....	394	<i>minuta</i> Bl. ....	398
<i>Bidara pubiflora</i> Miq. ....	372	<i>moluccana</i> Roxb. ....	399
<i>syringaeifolia</i> (Decne) Decne... 372		<i>monadelpha</i> Bl. ....	398
<i>Bignonia albida</i> Bl. ....	395	<i>nudiflora</i> L. ....	399
<i>angustifolia</i> Bl. ....	395	<i>obliqua</i> Buch.-Ham ex DC. ....	399
<i>Blaberopus</i> DC. ....	393	<i>oligotricha</i> Miq. ....	399
<i>neriifolius</i> (D. Don) DC. ....	393	<i>paludosa</i> Bl. ....	399
<i>sericeus</i> (Bl.) DC. ....	393	<i>scaberrima</i> Bl. ....	399
<i>Boehmeria</i> ** <i>glomerulifera</i> Miq. ....		<i>secundiflora</i> Bl. ....	399
var. <i>neglecta</i> (Bl.) Bakh. f. ... 364		<i>spirata</i> L. ....	399
<i>neglecta</i> (Bl.) Bakh. f. .... 364		<i>subfruticosa</i> Bl. ....	399
<i>Boerlagiodendron</i> ** <i>moluccanum</i> ....		<i>suffruticosa</i> Bl. ....	399
(Miq.) v. Ooststr. ....	367	<i>Commelinaceae</i> ....	398
<i>palmatum</i> (Zipp. ex Boerl.) ....		<i>Conchophyllum imbricatum</i> Bl. ... 377	
Harms ....	367	<i>Connaraceae</i> ....	365
<i>Busca asperifolia</i> (Bl.) Miq. .... 394		<i>Connarus ellipticus</i> King ....	365
<i>Calotropis gigantea</i> (L.) Dryand. 370		<i>ellipticus</i> (Zoll.) Schell. ....	365
<i>Catharanthus roseus</i> (L.) G. Don 384		** <i>gracilis</i> Bakh. f. ....	365
<i>roseus</i> (L.) G. Don var. <i>angus-</i>		<i>Cosmostigma racemosum</i> (Roxb.)	
<i>tus</i> v. <i>Steenis</i> ex Bakh. f. ... 384		Wight ....	373
<i>Centronia mirabilis</i> Bl. ....	393	<i>Cryptolepis javanica</i> (Bl.) Bl. ... 369	
<i>Centrostemma laurifolium</i> Bl. .... 379		<i>laxiflora</i> Bl. var. <i>obversa</i> Miq. 369	
<i>multiflorum</i> (Bl.) Deene .... 379		<i>Cryptostegia glaberrima</i> Hochr. ... 369	
<i>Cerbera</i> L. ....	386	<i>grandiflora</i> R. Br. ....	369
<i>fruticosa</i> Ker. ....	390	<i>madagascariensis</i> Bojer ....	369
<i>lactaria</i> Ham. ....	387	<i>Cyanotis axillaris</i> (L.) D. Don ... 399	
<i>manghas</i> L. ....	386	<i>capitata</i> (Bl.) Clarke ....	399
<i>odollam</i> Gaertn. ....	387	** <i>ciliata</i> (Bl.) Bakh. f. ....	399
<i>Ceropegia curviflora</i> Hassk. .... 373		<i>cristata</i> (L.) D. Don ....	399
<i>horsfieldiana</i> Miq. ....	373	<i>moluccana</i> (Roxb.) Merr. ....	399
<i>Chamabainia cuspidata</i> Wight.... 364		<i>uniflora</i> Hassk. ....	399
<i>Chavannesia</i> ....	388	<i>vaga</i> (Bl.) R. et S. ....	399
<i>brachysepala</i> (B. et H.) Pich. 388		<i>Cynanchum</i> L. ....	369
<i>Chilocarpus</i> Bl. ....	385	<i>capillare</i> Thunb. ....	369
<i>atroviridis</i> Bl. ....	385	<i>carnosum</i> (R. Br.) Schltr. ....	370
<i>compositus</i> Bl. ....	385	<i>dimidiatum</i> (Hassk.) Boerl. 369, 370	
<i>densiflorus</i> Bl. ....	385	* <i>hoedimeerium</i> Bakh. f. ... 369, 370	
<i>denudatus</i> Bl. ....	385	<i>indicum</i> Burm. f. ....	374
<i>globuliferus</i> Bl. ....	385	** <i>javanicum</i> (Kds.) Bakh. f. ....	369
<i>suaveolens</i> Bl. ....	385	<i>laeve</i> (Bl.) K. Schum. ....	369
<i>suaveolens</i> Bl. var. <i>borneensis</i>		<i>macrophyllum</i> Thunb. ....	369
Hall. f. ....	385	<i>muricatum</i> (Bl.) Boerl. ....	369
<i>suaveolens</i> Bl. var. <i>salaccensis</i>		<i>ovalifolium</i> Wight ....	369
Hochr. ....	385	<i>zollingeri</i> (Miq.) Boerl. ....	369
<i>Chirita blumei</i> Clarke ....	394	<i>Cynoctionum</i> ** <i>mitreola</i> (L.) Britt.	
<i>coerulea</i> R. Br. ....	394	var. <i>lilacinum</i> (Back. apud	
<i>horsfieldii</i> R. Br. ....	394	Canmerl.) Bakh. f. ....	382
<i>zollingeri</i> Clarke ....	394	<i>zollingeri</i> Miq. ....	369
<i>Chonemorpha</i> G. Don ....	388	<i>Cyrtandra ampla</i> Clarke ....	397

<i>arborescens</i> Bl. ....	397	<i>**zollingeri</i> (Clarke) O. K. var.	
<i>aurea</i> Jack .....	395	<i>cyathiflora</i> Bakh. f. ....	394
* <i>calyptribracteata</i> Bakh. f. ....	396	<i>Dischidia</i> R. Br. ....	376
<i>carnosa</i> Jack .....	398	<i>cochleata</i> Bl. ....	377
<i>cordifolia</i> de Vriese, non Gaud. ....	395	<i>collyris</i> Wall. ....	377
<i>cuneata</i> , auct. div. non Blume ....	396	<i>glabra</i> Warb. ....	377
* <i>elbertii</i> Bakh. f. ....	396	<i>gaudichaudii</i> Deene ....	377
<i>glabra</i> , non Jack .....	397	<i>horsfieldiana</i> Miq. ....	377
** <i>grandis</i> Bl. var. <i>ampla</i> (Clarke)		<i>imbricata</i> (Bl.) Steud. ....	377
Bakh. f. ....	397	<i>imbricata</i> , apud Auct. div., non	
** <i>grandis</i> Bl. var. <i>rubra</i> (de		Steud. ....	377
Vriese) Bakh. f. ....	397	<i>nummularia</i> R. Br. ....	377
<i>heterophylla</i> de Vriese .....	397	** <i>nummularia</i> R. Br. var. <i>glabra</i>	
<i>humilis</i> Bl. ....	397	(Warb.) Bakh. f. ....	377
<i>longepetiolata</i> de Vriese .....	397	** <i>nummularia</i> R. Br. var. <i>rhombi-</i>	
<i>nemorosa</i> Bl. ....	397	<i>folia</i> (Bl.) Bakh. f. ....	377
** <i>nemorosa</i> Bl. var. <i>heterophylla</i>		<i>oxyphylla</i> Miq. ....	377
(de Vriese) Bakh. f. ....	397	<i>punctata</i> , apud Auct., non Bl.	377
<i>pendula</i> Bl. ....	397	* <i>punctatoides</i> Bakh. f. ....	377
<i>pendula</i> Bl. var. <i>blumeana</i>		<i>rafflesiana</i> Wall. ....	377
Clarke .....	397	<i>rhombifolia</i> Bl. ....	377
<i>pendula</i> Bl. var. <i>genuina</i> Hochr.	397	<i>spironema</i> Turez. ....	377
* <i>pendula</i> Bl. var. <i>subsessilis</i>		* <i>tjidadapensis</i> Bakh. f. ....	378
Bakh. f. ....	397	<i>zollingeri</i> Schltr. ....	377
<i>picta</i> Bl. ....	397	Dregea .....	373
** <i>picta</i> Bl. var. <i>repens</i> (de		<i>pubescens</i> (Miq.) Boerl. ....	373
Vriese) Bakh. f. ....	397	<i>volubilis</i> (L. f.) Benth. et	
<i>populifolia</i> Miq. ....	397	Hook. f. ....	373
<i>populifolia</i> Miq. var. <i>rein-</i>		<i>Droguetia pauciflora</i> Wedd. ....	364
<i>wardtii</i> Clarke .....	397	<i>Dubruelii</i> <i>peplodes</i> Gaud. ....	363
** <i>reinwardtii</i> (Clarke) Bakh. f. .	397	<i>Dyera</i> Hook. f. ....	385
<i>repens</i> de Vriese .....	397	<i>costulata</i> (Miq.) Hook. f. ....	385
<i>reticosa</i> Clarke .....	397	<i>Ecdysanthera</i> Hook. et Arn. ....	387
* <i>rostrata</i> Bl. var. <i>sericea</i> Bakh. f.	397	<i>barbata</i> (Bl.) Miq. ....	387
<i>rubra</i> de Vriese .....	397	<i>barbata</i> (Bl.) Miq. var. <i>angus-</i>	
** <i>rufa</i> Bakh. f. ....	398	<i>tor</i> Miq. ....	387
<i>Cyrtoceras laurifolia</i> (Bl.) Miq. ...	379	<i>Ecdysanthereae</i> .....	384
<i>Cyrtosiphonia madurensis</i> T. et B.	386	<i>Echites densiflora</i> Bl. ....	387
<i>spectabilis</i> Miq. ....	386	<i>fragrans</i> (Rheede) Moon ....	388
<i>Debregeasia dichotoma</i> (Bl.) Wedd.	364	<i>inflata</i> Bl. ....	387
* <i>longifolia</i> (Burm. f.) Wedd.		<i>religiosa</i> T. et B. ....	393
<i>forma dichotoma</i> (Bl.)		<i>Elatostemma *abangense</i> Amsh. ...	364
Bakh. f. ....	364	<i>bulbiferum</i> Kurz .....	365
<i>Dichaespermum blumei</i> Hassk. ....	398	<i>pedunculatum</i> Forst. ....	364
<i>Dichotrichum asperifolium</i> (Bl.)		<i>Ellodium</i> Bl. ....	394
Benth. et Hook. f. ex Clarke..	394	<i>montanum</i> Bl. ....	394
<i>Dictyospermum ovatum</i> Hassk. ....	399	<i>Epithema difforme</i> Span. ....	395
<i>wrightii</i> Hassk. ....	399	<i>horsfieldii</i> (R. Br.) R.Br. ex	
<i>Didissandra</i> Clarke .....	394	DC .....	395
* <i>montana</i> (Bl.) Bakh. f. ....	394	<i>Ervatamia</i> Stapf .....	385
<i>Didymocarpus **asperifolia</i> (Bl.)		<i>blumeana</i> Mgff. ....	385
Bakh. f. ....	394	* <i>blumeana</i> Mgff. var. <i>macro-</i>	
<i>barbata</i> Jack .....	394	<i>petala</i> Bakh. f. ....	385
<i>coerulea</i> Ridley .....	394	<i>floribunda</i> (Bl.) Pich. ....	385
<i>coerulea</i> (R. Br.) Kds. ....	394	<i>pauciflora</i> Ridley .....	385
<i>cyathiflora</i> Reichb. f. et Zoll.	394	* <i>pubescens</i> (R. Br.) Mgff. var.	
<i>horsfieldii</i> (R. Br.) O. K. ex		<i>glaberrima</i> Bakh. f. ....	386
Kds. ....	394	<i>sphaerocarpa</i> (Bl.) Burk. ....	385
<i>repens</i> , non Jack .....	394	<i>Eschweilera palmata</i> Zipp. ex	
<i>zollingeri</i> (Clarke) Kds. ....	394	Boerl. ....	367
<i>zollingeri</i> (Clarke) O. K. ....	394	<i>Euodia accedens</i> Bl. ....	365

<i>aromatica</i> Bl. ....	365	Seem. ....	368
** <i>incisifolia</i> Bakh. f. ....	365	<i>grandifolium</i> K. et V. ....	368
<i>glabra</i> Bl. ....	365	<i>laeve</i> K. et V. ....	367
<i>macrophylla</i> Bl. ....	365	<i>serratum</i> (Miq.) Seem. ....	367
<i>nervosa</i> K. et V. ....	365	Heterosmilax ....	400
<i>sambucina</i> (Bl.) Hook. f. ex		Heterosmilax <i>japonica</i> Kunth var.	
K. et V. ....	366	<i>javanica</i> DC. ....	400
** <i>suaveolens</i> Scheff. var. <i>ridleyi</i>		<i>micrantha</i> (Bl.) Bakh. f. ....	400
(Hochr.) Bakh. f. ....	365	Heterostemma <i>acuminatum</i> Decne	373
<i>trichotoma</i> (Lour) Pierre ....	365	<i>chrysanthum</i> (Hassk.) Boerl. ....	373
<i>triphylla</i> Hort. Bog. ex Back. ....	365	<i>javanicum</i> Hassk. ....	373
<i>Evodia ridleyi</i> Hochr. ....	365	* <i>Heynella</i> Back. ....	381
<i>triphylla</i> DC. ....	365	* <i>lactea</i> Back. ....	381
Fagara * <i>backeri</i> Bakh. f. ....	366	<i>Holarrhena macrocarpa</i> (Hassk.)	
<i>glabra</i> Bl. ....	365	Villar ....	393
* <i>oblongifolia</i> Bakh. f. ....	366	<i>Holostemma laeve</i> Bl. ....	369
* <i>pendjaluensis</i> Bakh. f. ....	366	Hoya R. Br. ....	378
<i>torva</i> (F. v. M.) Engl. ....	367	* <i>amoena</i> Bakh. f. ....	380
Fagraea <i>blumei</i> G. Don ....	382	<i>browniana</i> Kds. ....	379
<i>blumei</i> Steud. ....	382	<i>cinnamomifolia</i> Hook. ....	379
<i>elliptica</i> Roxb. ....	382, 383	<i>clandestina</i> Bl. ....	379
** <i>javanensis</i> (Bl.) Bakh. f. ....	382	<i>coriacea</i> Bl. ....	378
<i>kimangu</i> Bl. ....	382	<i>coronaria</i> Bl. ....	378
<i>lanceolata</i> Bl. ....	382	<i>crassipes</i> Turcz. ....	378
<i>obovata</i> Wall. ex Roxb. ....	382	<i>densifolia</i> Turcz. ....	378
* <i>obovata</i> Wall. ex Roxb. var.		<i>diversifolia</i> Bl. ....	378
<i>brevicalyx</i> Bakh. f. ....	382	<i>esculenta</i> (Rumph.) Tsiang ...	378
<i>obovata-javana</i> Bl. ....	382	<i>fraterna</i> Bl. ....	378
<i>oxyphylla</i> Miq. ....	382	<i>hasseltii</i> (Bl.) Miq. ....	379
* <i>pusilliflora</i> Bakh. f. ....	383	<i>javanica</i> Boerl. ....	379
<i>vaginata</i> King et Gamble ....	382	<i>kühlii</i> (Bl.) Kds. ....	378
Finlaysonia <i>maritima</i> Back. ex		* <i>kühlii</i> (Bl.) Kds. var. <i>hasseltii</i>	
Heyne ....	369, 371	(Bl.) Bakh. f. ....	379
<i>obovata</i> Wall. ....	369	<i>lacunosa</i> Bl. ....	379
Flagellariaceae ....	399	<i>lacunosa</i> Bl. var. <i>pallidiflora</i>	
Genianthus Hook. f. ....	371	Hook. ....	379
<i>blumei</i> (Decne) Boerl. ....	371	<i>lasiantha</i> Korth. ex Bl. ....	379
** <i>ellipticus</i> (Bl.) Bakh. f. ....	371	<i>latifolia</i> , apud auct., non G. Don	379
Gesneriaceae ....	394	<i>laurifoliopsis</i> Hochr. ....	380
Girardinia <i>hibiscifolia</i> Miq. ....	364	(sphalm.) <i>leembruggeniana</i> Kds.	380
<i>heterophylla</i> (Vahl) Decne ....	364	<i>leembruggiana</i> Kds. ....	380
<i>palmata</i> Gaud. ....	364	<i>longifolia</i> (Bl.) Miq. ....	378
Glycosmis <i>citrifolia</i> (Willd.) Link	366	<i>macrophylla</i> Bl. ....	379
** <i>elongata</i> Bakh. f. ....	366	<i>multiflora</i> Bl. ....	379
<i>longifolia</i> Tanaka ....	366	<i>pieta</i> (Bl.) Miq. ....	379
** <i>pentaphylla</i> (Retz.) Corr. var.		<i>polystachya</i> Bl. ....	379
<i>citrifolia</i> (Willd.) Bakh. f. ....	366	<i>puber</i> Bl. ....	379
Gonostegia * <i>hirta</i> (Bl.) Miq. var.		<i>pubera</i> Bl. ....	379
<i>crassissima</i> Bakh. f. ....	364	<i>purpureo-fusca</i> Hook. ....	379
* <i>Grisseea</i> Bakh. f. ....	392, 393	<i>purpureo-fusca</i> , apud Koorders,	
* <i>apiculata</i> Bakh. f. ....	392	non Hook. ....	380
Gymnema <i>acuminatum</i> Wall. ....	372	<i>rumphii</i> Bl. ....	379
<i>pubiflora</i> (Miq.) Hook. ex Kds.	372	<i>subquaterna</i> Miq. ....	380
<i>syringaeifolia</i> (Decne) Boerl. ...	372	* <i>tenggerensis</i> Bakh. f. ....	380
<i>Gynopogon reinwardti</i> (Bl.) Kds.	389	* <i>tjadasmalangensis</i> Bakh. f. ....	380
** <i>Hanguana malayana</i> (Jack. Merr.		<i>tjampeensis</i> Hochr. ....	380
var. <i>anthelmintica</i> (Bl. ex R.		<i>uncinata</i> T. et B. ....	379
et S.) Bakh. f. ....	399	<i>viridiflora</i> R. Br. ....	373
<i>Helygia javanica</i> Bl. ....	392	<i>vitellina</i> Bl. ....	381
<i>Helyme korthalsiana</i> Miq. ....	391	* <i>vitellinoides</i> Bakh. f. ....	381
<i>Heptapleurum euryhynchum</i> (Miq.)		<i>zollingeriana</i> Miq. ....	378



<i>Hunteria sundana</i> Miq. ....	386	<i>? javanica</i> Kds. ....	369
<i>Hybanthera villosa</i> Miq. ....	375	<i>parviflora</i> (Bl.) Decne. ....	374
<i>Ichnocarpus dasycalyx</i> Miq. ....	387	* <i>stenocentra</i> Bakh. f. ....	374
<i>frutescens</i> (L.) R. Br. ....	387	<i>syringaeifolia</i> Decne. ....	372
<i>Isanthera eximia</i> Clarke ....	394	<i>tenacissima</i> W. et A. ....	374
<i>Ischnostemma carnosum</i> (R. Br.)		<i>teysmanni</i> (Hassk.) Boerl. ....	373
Merr. et Rolfe ....	370	<i>tinctoria</i> R. Br. ....	374
<i>Jasminum acuminatissimum</i> Bl. ...	383	<i>villosa</i> (Bl.) Hassk., non Bl. ...	375
<i>affine</i> Bl. ....	384	<i>villosa</i> (Bl.) Bl. ex Miq., non	
<i>glabriusculum</i> Bl. ....	383	Hasskarl ....	374
<i>mixtinervium</i> Bl. ....	384	<i>volubilis</i> (L. f.) Cooke ....	373
<i>multiflorum</i> (Burm. f.)		<i>Melodinus</i> Forst. ....	384
Andr. ....	383	<i>laevigatus</i> Bl. ....	384
** <i>multiflorum</i> (Burm. f.) Andr.		<i>laxiflorus</i> Bl. ....	384
<i>forma acuminatissimum</i>		<i>orientalis</i> Bl. ....	384
(Bl.) Bakh. f. ....	383	* <i>Memoralis hirta</i> Wedd. ....	364
** <i>multiflorum</i> (Burm. f.) Andr.		<i>Micrechites</i> Miq. ....	389
<i>forma glabriusculum</i> (Bl.)		<i>micrantha</i> (Miq.) Hall. f. ....	389
Bakh. f. ....	383	<i>schrieckii</i> (v. Heurck et M.	
** <i>multiflorum</i> (Burm. f.) Andr.		Arg.) Rolfe ....	389
<i>forma pubescens</i> (Willd.)		<i>Micromelum minutum</i> (Forst. f.)	
Bakh. f. ....	383	W. et A. ....	365
** <i>multiflorum</i> (Burm. f.) Andr.		<i>pubescens</i> Bl. ....	365
<i>forma subelongatum</i> (Bl.)		<i>Miqelia azurea</i> Bl. ....	394
Bakh. f. ....	384	<i>coerulea</i> Bl. ....	394
<i>pedale</i> Bl. ....	384	<i>Mississyya</i> Gaud. ....	365
<i>pendulum</i> Bl. ....	384	* <i>capitellata</i> (Poir.) Bakh. f. ...	365
<i>pubescens</i> Willd. ....	383	<i>Mitreola paniculata</i> Wall. ex G.	
<i>quinquenervium</i> Bl. ....	384	G. Don var. <i>vilacinum</i> Back.	
<i>subelongatum</i> Bl. ....	384	<i>apud</i> Cammerl. ....	382
<i>subpubescens</i> Bl. ....	384	<i>Monophyllaea horsfieldii</i> R. Br. ...	394
<i>vulcanicum</i> Bl. ....	384	<i>pygmaea</i> Clarke ....	395
<i>Kentrochrosia monocarpa</i> Lauterb.		<i>Murraya longifolia</i> Bl. ....	366
et K. Schum. ....	391	<i>Myriopteron</i> ....	374
<i>Kopsia</i> ....	391	<i>extensum</i> ....	375
<i>flavida</i> , <i>apud</i> Auct., non Blume	391	<i>horsfieldii</i> (Miq.) Hook. f. ....	374
<i>flavida</i> Bl. ....	391	<i>Nerium indicum</i> Mill. ....	387
<i>fruticosa</i> (Ker.) DC. ...	390, 391	<i>oleander</i> L. ....	387
* <i>pruniformis</i> Reichb. f. et Zoll.		<i>Nyctanthes multiflora</i> Burm. f. ...	383
ex Bakh. f. ....	391	<i>Ochrosia</i> Juss. ....	386
<i>vincaeflora</i> Bl. ....	391	<i>akkeringae</i> (T. et B.) Miq. ...	386
<i>Lactaria ackeringae</i> T. et B. ....	386	<i>borbonica</i> Auct. non Gmel. ...	386
<i>Landolphia gummifera</i> (Lmk.)		<i>Oleaceae</i> ....	383
K. Schum. ....	384	<i>Ophiorhylon majus</i> Hassk. ....	386
<i>Leposma javanicum</i> Bl. ....	369	<i>obversum</i> Miq. ....	386
<i>Leptadenia ? elliptica</i> Bl. ....	371	<i>serpentinum</i> L. ....	386
<i>Leucosyke</i> Z. et M. ....	365	<i>trifoliatum</i> Gaertn. ....	386
<i>capitellata</i> (Poir.) Wedd. ....	365	<i>Orobanchaceae</i> ....	393
<i>Limonia citrifolia</i> Willd. ....	366	<i>Otopetalum</i> Miq. ....	389
<i>minuta</i> Forst. f. ....	365	<i>micranthum</i> Miq. ....	389
<i>Lobelia clobum</i> (Bl.) Kds. ....	394	<i>Oxystelma carnosum</i> R. Br. ....	370
<i>Lochnera rosea</i> (L.) Reichb. ....	384	<i>esculentum</i> (L. f.) R. Br. ....	371
<i>rosea</i> (L.) Reichb. ex Endl. ...	384	<i>Pagiania sphaerocarpa</i> (Bl.) Mgf.	385
<i>rosea</i> (L.) Reichb. ex Endl. var		<i>Paladelpia</i> Pichon ....	393
<i>angusta</i> v. Steenis ....	384	<i>Parameria angustior</i> (Miq.) Boerl.	387
<i>Loganiaceae</i> ....	382	<i>barbata</i> (Bl.) K. Schum. ....	387
<i>Loxonia acuminata</i> R. Br. ....	395	<i>laevigata</i> (Juss.) Mold. ....	387
<i>discolor</i> Jack ....	395	<i>Paratropia brachybotrya</i> Miq. ....	368
<i>hirsuta</i> Jack ....	395	<i>corona-sylvae</i> Miq. ....	368
<i>Marsdenia crocea</i> (Zipp. ex Span.)		<i>eurhyncha</i> Miq. ....	368
Hook. f. ex Boerl. ....	374	<i>fastigiata</i> Miq. ....	367

<i>junghuhniana</i> Miq. ....	368	Jack .....	386
<i>lucida</i> (Bl.) Miq. ....	368	<i>Rhynchoecarpus pallidus</i> Bl. ....	397
<i>polyphylla</i> Miq. ....	368	<i>Rhynchodia</i> .....	389
<i>polybotrya</i> Miq. ....	368	** <i>slootenii</i> (Tsiang) Tsiang .....	389
<i>serrata</i> Miq. ....	367	<i>verrucosa</i> (Bl.) Woods. ....	389
<i>Parietaria debilis</i> Forst. f. ....	364	<i>Rhynchothecum eximium</i> (Clarke)	
<i>microphylla</i> L. ....	363	Schltr. ....	394
<i>Parsonsia</i> R. Br. ....	391, 392	<i>Rhynchothecum</i> .....	394
<i>barbata</i> Bl. ....	387	<i>Roupellia grata</i> Benth. ....	393
<i>javanica</i> Bl. ....	392	<i>Rutaceae</i> .....	365
<i>korthalsiana</i> (Miq.) Boerl. ....	391	<i>Sarcobolus</i> R. Br. ....	372
<i>laevigata</i> (Moon) Alst. ....	391	<i>banksii</i> R. et S. ....	372
<i>oblonga</i> Wall. ex Don ....	392	<i>globosus</i> Wall. ....	372
<i>spiralis</i> Wall. ex G. Don ....	391	<i>narcoticus</i> Span. ex Miq. ....	372
<i>Pergularia accedens</i> Bl. ....	373	<i>spanoghei</i> Miq. ....	372
<i>apiculata</i> Warb. ....	373	<i>Schefflera aromatica</i> (Bl.) Harms	367
<i>bifida</i> Zipp. ....	373	<i>corona-sylvae</i> (Miq.) Kds. ....	368
<i>crocea</i> Zipp. ex Span. ....	374	<i>curhyncha</i> (Miq.) Vig. ....	368
<i>parviflora</i> Bl. ....	374	<i>fastigiata</i> (Miq.) Vig. ....	367
<i>puberula</i> Miq. ....	373	<i>grandifolia</i> (K. et V.) Kds. ....	368
<i>villosa</i> Bl. ....	374	<i>junghuhniana</i> (Miq.) Harms ...	367
<i>Periplocia extensa</i> .....	374	<i>laevis</i> (K. et V.) Kds. ....	367
<i>Philagonia sambucina</i> Bl. ....	366	<i>longifolia</i> (Bl.) Vig. ....	368
<i>Phyllanthera bifida</i> Bl. ....	368	<i>lucescens</i> (Bl.) Vig. ....	368
<i>Physetobasis</i> Hassk. ....	393	** <i>lucescens</i> (Bl.) Vig. var. gran-	
<i>macrocarpa</i> Hassk. ....	393	<i>difolia</i> (K. et V.) Bakh. f. ....	368
<i>Picrophloeus javanensis</i> Bl. ....	382	<i>lucescens</i> (Bl.) Vig. var. <i>rigida</i>	
<i>Pilea angulata</i> (Bl.) Bl. ....	363	(Bl.) Harms .....	368
<i>glaberrima</i> (Bl.) Bl. ....	363	<i>lucescens</i> (Bl.) Vig. var. <i>typica</i>	368
<i>leucophaea</i> (Bl.) Bl. ....	363	<i>pergamacca</i> (Bl.) Vig. ....	368
<i>leucophlaea</i> .....	363	<i>polybotrya</i> (Miq.) Vig. ....	368
<i>melastomoides</i> (Poir.) Bl. ....	363	<i>rigida</i> (Bl.) Harms. ....	368
<i>miconiaefolia</i> Miq. ....	363	<i>scandens</i> (Bl.) Vig. ....	368
<i>microphylla</i> (L.) Liebm. ....	363	<i>subavenis</i> (Bl.) Hochr. ....	368
<i>oreophila</i> (Miq.) Miq. ....	363	** <i>subavenis</i> (Bl.) Hochr. var.	
<i>pellucida</i> Bl. ....	363	<i>eurhyncha</i> (Miq.) Bakh. f. ....	368
<i>peploides</i> (Gaud.) Hook. et		<i>Sciadiaphyllum longifolium</i> Bl. ...	368
Arn. ....	363	<i>lucidum</i> Bl. ....	368
<i>smilacifolia</i> (Wall. ex Voigt)		<i>scandens</i> Bl. ....	368
Wedd. ....	363	<i>subavene</i> Bl. ....	368
<i>stipulosa</i> (Miq.) Miq. ....	363	<i>Secamone</i> R. Br. ....	371
<i>subpuber</i> Miq. ....	363	<i>blumei</i> Deene .....	371
<i>trinervia</i> (Roxb.) Wight ....	363	<i>fulva</i> Kds. ....	371
<i>Plumeria</i> L. ....	385	<i>insularis</i> Miq. ....	371
<i>acutifolia</i> Poir. ....	385	<i>lanceolata</i> Bl. ....	271
<i>acuminata</i> Ait. ....	385	<i>macrophylla</i> Bl. var. <i>fulva</i> Bl.	371
<i>Pollia elegans</i> Hassk. ....	399	<i>maritima</i> Bl. ....	369, 371
** <i>secundiflora</i> (Bl.) Bakh. f. ...	399	<i>micrantha</i> (Deene) Deene .....	371
<i>sorzogonensis</i> (E. Mey) Endl.	399	<i>villosa</i> Bl. ....	371
<i>thyrsiflora</i> (Bl.) Endl. ....	399	<i>Smilax micrantha</i> Bl. ....	400
<i>Procris longifolia</i> Bl. ....	364	<i>Smilacaceae</i> .....	400
<i>pedunculata</i> (Forst.) Wedd. ...	364	<i>Stauranthera coerulea</i> (Bl.) Merr.	394
<i>Rauwolfia</i> L. ....	386	<i>ecalecarata</i> R. Br. ....	394
<i>blumeana</i> Val. ex Kds. ....	386	<i>Stephanotis</i> Thou. ....	381
<i>madurensis</i> Burek. ex Kds. ...	386	<i>floribunda</i> Brongn. ....	371
<i>reflexa</i> T. et B. ....	386	<i>Streptocaulon extensum</i> Wight ...	373
<i>serpentina</i> (L.) B. et H. ....	386	<i>horsfieldii</i> Miq. ....	373, 374
** <i>serpentina</i> (L.) B. et H. var.		<i>Strophantus gratus</i> (Benth.) Baill.	393
<i>obversa</i> (Miq.) Bakh. f. ...	386	<i>Susum anthelminticum</i> Bl. ex R.	
<i>spectabilis</i> (Miq.) B. et H. ...	386	et S. ....	399
<i>sumatrana</i> , apud auct., non		<i>malayanum</i> (Jack) Planch. var.	

<i>aquatica</i> Back. ....	399	<i>miquelii</i> Boerl. ....	375
<i>Symphysicarpus chrysanthus</i> Hassk. ....	373	* <i>pilosissima</i> Bakh. f. ....	376
<i>Tabernaemontana</i> .....	385	<i>rupestris</i> Bl. ....	375
<i>fragracoides</i> Miq. ....	385	<i>tenuis</i> Bl. ....	374
<i>floribunda</i> Bl. ....	385	<i>villosa</i> Bl. ....	375
<i>javanica</i> Miq. ....	385	<i>villosa</i> Auct. non Bl. ....	375
<i>pauciflora</i> Bl. ....	385	Urceola .....	388
<i>polyantha</i> Bl. ....	389	<i>brachysepala</i> B. et H. ....	388
<i>sphaerocarpa</i> Bl. ....	385	<i>javanica</i> .....	388
Telosma ** <i>accedens</i> (Bl.) Back. ....	373	<i>lucida</i> B. et H. ....	388
<i>cordata</i> (Burm. f.) Merr. ....	373	Urnularia Stapf .....	385
<i>Tetradema asperifolium</i> (Bl.)		<i>Urtica angulata</i> Bl. ....	363
Schltr. ....	394	<i>capitellata</i> Poir. ....	365
<i>Tetragonocarpus teysmanni</i> Hassk. ....	373	<i>dichotoma</i> Bl. ....	364
Toxocarpus W. et A. ....	371	<i>dioica</i> L. ....	363
<i>blumei</i> Decne. ....	371	<i>glaberrima</i> Bl. ....	363
<i>glaucus</i> Decne. ....	371	<i>leucophaea</i> Bl. ....	363
<i>griffithii</i> Decne. ....	371	<i>melastomoides</i> Poir. ....	363
* <i>insularis</i> (Miq.) Bakh. f. ....	371	<i>oreophila</i> Miq. ....	363
<i>longipetalus</i> Merr. ....	371	<i>smilacifolia</i> Wall. ex Voigt ...	363
<i>maritimus</i> (Bl.) Miq. ....	371	<i>stipulosa</i> Miq. ....	363
* <i>rhopalophorus</i> Back. ....	371	<i>trinervia</i> Roxb. ....	363
<i>villosus</i> (Bl.) Decne. ....	371	<i>urens</i> L. ....	363
<i>Trachelospermum</i> .....	388	Urticaceae .....	363
<i>inflatum</i> (Bl.) Pierre ex Pichon ....	388	<i>Vahca gummifera</i> Lamk. ....	384
<i>slootenii</i> Tsiang .....	388	<i>Vandellia ellobum</i> (Bl.) Benth. ...	394
<i>Tradescantia capitata</i> Bl. ....	399	Voacanga * <i>grandiflora</i> (Miq.)	
<i>ciliata</i> Bl. ....	399	Rolfe var. <i>glabrifolia</i> Bakh. f. ....	386
<i>thyrsiflora</i> Bl. ....	399	<i>Wattakaka pubescens</i> Miq. ....	373
<i>Trevesia moluccana</i> Miq. ....	367	<i>viridiflora</i> (R. Br.) Hassk. ...	373
<i>Trichosporum</i> D. Don .....	395	<i>volubilis</i> (L. f.) Stapf. ....	373
<i>Tromsdorffia speciosa</i> Bl. ....	394	<i>Whitia carnosa</i> Bl. ....	398
Tylophora * <i>adnata</i> Bakh. f. ....	375	<i>Willughbeia</i> Roxb. ....	384
<i>asthmatica</i> W. et A. ....	374, 375	<i>Willughbeia firma</i> Bl. ....	385
<i>cacumba</i> Willd. ....	374	<i>umbrosa</i> Bl. ....	384
<i>chlorantha</i> Miq. ....	375	Wrightia <i>calycina</i> A. DC. ....	393
<i>cisoides</i> Bl. ....	374	<i>javanica</i> A. DC. ....	393
<i>cuspidata</i> Zipp. ex Decne. ....	375	<i>pubescens</i> R. Br. ....	393
* <i>dorgelonis</i> Bakh. f. ....	375	<i>religiosa</i> (T. et B.) B. et H. ....	393
<i>exilis</i> Colebr. ....	374	Xylinabaria .....	388
<i>indica</i> (Burm. f.) Merr. ....	374	<i>Xylinabaria bantamensis</i> Pierre	
<i>laevis</i> Decne. ....	374, 375	ex Pichon .....	388
<i>micrantha</i> Decne. ....	371	<i>koordersii</i> Pierre ex Pichon ...	388



# WOOD-ANATOMY AND RELATIONSHIP

## Taxonomic Notes in connection with the Key to the Javanese Woods

by

H. H. JANSSENIUS

(Amsterdam)

### CONTENTS.

	P.
Introduction . . . . .	408
References . . . . .	411
Note 1. On the similarity of the wood in some Leguminosae, Combretaceae, Sapindaceae, and Meliaceae . . . . .	411
Note 2. Possible relationship of Euphorbiaceae with various other families . . . . .	414
Note 3. A subdivision of Melastomaceae . . . . .	417
Note 4. The consequences of the use of an unstable wood-anatomical character . . . . .	418
Note 5. The aberrant wood-anatomy of <i>Grewia microcos</i> (Tiliac.) . . . . .	419
Note 6. The wood-anatomy of <i>Javan Schoutenia</i> . . . . .	420
Note 7. Fibre tracheids and scalariform perforations and their correlation with the medullary rays (Notes 7—12) . . . . .	421
Note 8. Affinities among Olacineae, Styracaceae, and Symplocaceae . . . . .	422
Note 9. The genus <i>Saurauja</i> (Ternstroem.) and the Dilleniaceae . . . . .	423
Note 10. <i>Turpinia</i> (Staphyl.), <i>Symplocos</i> (Styrac.), <i>Ternstroemiaceae</i> , <i>Saxifragaceae</i> , and <i>Caprifoliaceae</i> . . . . .	423
Note 11. <i>Hamamelidaceae</i> , <i>Vacciniaceae</i> , and <i>Ternstroemiaceae</i> . . . . .	425
Note 12. <i>Viburnum</i> (Caprif.) and <i>Daphniphyllum</i> (Euphorb.); their relationships to <i>Hamamelidaceae</i> and <i>Ternstroemiaceae</i> . . . . .	425
Note 13. Scalariform perforations and a libriform fibrous ground mass . . . . .	426
Note 14. Simple and scalariform perforations in the division walls of the vessels in connection with fibre tracheids and libriform fibres . . . . .	427
Note 15. Simple perforations in the division walls of the vessels in correlation with fibre tracheids . . . . .	428
Note 16. Relationship of <i>Malvaceae</i> , <i>Sterculiaceae</i> , and <i>Tiliaceae</i> ; their tile cells . . . . .	429
Note 17. <i>Rubiaceae</i> , <i>Sonneratiaceae</i> , <i>Melastomaceae</i> , and <i>Connaraceae</i> . . . . .	429
Note 18. <i>Ampelidaceae</i> and <i>Araliaceae</i> . . . . .	430
Note 19. <i>Sapindaceae</i> , <i>Bursceraceae</i> , <i>Euphorbiaceae</i> , <i>Loganiaceae</i> , and several other families . . . . .	431
Note 20. <i>Lytharieae</i> and <i>Verbenaceae</i> . . . . .	433
Note 21. Classification of <i>Avicennia</i> (Verben.) . . . . .	434
Note 22. <i>Anacardiaceae</i> , <i>Sapindaceae</i> , and <i>Araliaceae</i> , &c. . . . .	434
Note 23. <i>Sapindaceae</i> , <i>Leguminosae</i> , and <i>Urticaceae</i> . . . . .	435
Note 24. <i>Polygaleae</i> , <i>Anonaceae</i> , <i>Sapotaceae</i> , <i>Scrophularineae</i> , and <i>Euphorbiaceae</i> . . . . .	436
Note 25. <i>Urticaceae</i> , <i>Araliaceae</i> , <i>Lytharicac</i> , <i>Rosaceae</i> , &c. . . . .	436
Note 26. <i>Sapotaceae</i> , <i>Euphorbiaceae</i> , <i>Myrtaceae</i> , <i>Sterculiaceae</i> , &c. . . . .	437
Note 27. <i>Sterculiaceae</i> , <i>Guttiferae</i> , <i>Urticaceae</i> , <i>Myrtaceae</i> , and <i>Oleaceae</i> . . . . .	439
Note 28. <i>Euphorbiales</i> , <i>Ebenales</i> , <i>Malvales</i> , and <i>Sapindales</i> , and their relationships . . . . .	440
Note 29. <i>Myrsineae</i> , <i>Moringeae</i> , <i>Malvaceae</i> , <i>Capparidaceae</i> , <i>Boragineae</i> , and <i>Leguminosae</i> . . . . .	443
Note 30. <i>Meliaceae</i> , <i>Combretaceae</i> , and <i>Rutaceae</i> . . . . .	444

	P.
Note 31. Rutaceae, Guttiferae, Hypericineae, Meliaceae, and Urticaceae . . .	445
Note 32. Rutales, Meliales, Sapindales, Guttiferales, and Tiliales . . .	447
Note 33. Combretaceae, Gesneriaceae, Capparidaceae, Aceraceae, and Rutaceae .	449
Note 34. Rhamnales, Leguminosae, Guttiferales, and Bignoniaceae . . .	450
Note 35. Combretaceae and Leguminosae, Relationships of Euphorbiaceae, Tiliales, Rutales, &c. . . . .	452
Index . . . . .	457

### Introduction.

During the long years I was engaged in writing my "Mikrographie" (1), my main purpose was to give a survey of the wood-anatomy of as many representatives of the javanese wood flora as I could lay hands on, in connection with Koorders' and Valetton's "Bijdragen" (2). My attention being almost exclusively absorbed by the descriptive side of my task, little attention was paid to eventual conclusions regarding family relationships, though some were incidentally pointed out.

When this work of long years was completed, the need of a key for the identification of wood samples was felt. This I composed and completed just before the war. It was published in 1940 and written in German (3), as was the main work on which it was based. Immediately an English translation was prepared but though this was ready for the press as early as 1942, I was prevented from publishing it, at first because of the German occupation and later on for want of funds.

This key is, as a matter of course, entirely artificial, as all keys naturally must be to a certain extent. However, this one was particularly and purposely free from any taxonomical premeditation. No attempt whatever was made to build it up on the basis of one of the wellknown taxonomical systems. On the contrary, I consciously avoided to do so; I do not agree with the opinion of those authors like Pfeiffer (7) who assert that their keys grow more useful, as a closer connection with an existing system is strived at. My sole object and aim was to lead the user along the safest and shortest way to the information he is after, along the lines of anatomical evidence.

Of course, anatomical characters as well as any others, take their share in the complex of features characterising natural groups, as understood by modern typology (4, 5). Also in this field, however, it is true what has been repeatedly stated by various authors for other kinds of characters, that what is all to easily called 'relationship' is oftentimes nothing but similarity or even resemblance. This is not yet generally understood, though. I fully agree with the introduction to Metcalfe's paper of 1946 (6), also in this respect.

It is true that the accurate reader — if he would be inclined to take the pains — could trace from the key various relationships on an anatomical basis. This would, however, be a tedious task, which nobody would care to tackle without some sort of guidance from the author. A key like this is deceptive in as far as taxa, supposedly related on morphological grounds, may be found far apart, and likewise taxa which are supposed to be not, or only distantly related, may be found close together. This, of course, is due to the different ways of sharing and participation

of characters in any large group as well as to the fact that the key is based upon one category of characters only. Many characters are so whimsically scattered all over a natural group that its internal relationships seem to be interwoven like the strings in a network. Moreover, a given character may be entirely constant in one taxon, more or less variable in another, entirely 'untrustworthy' in a third.

So as to disentangle for the reader what may be hidden in the mass of lines through the Key, so as to show as clearly as possible what obvious — or less obvious, as the case may be — conclusions lie concealed in its network, is one of the main purposes of this paper, conclusions, as I sometimes use to say to my friends, which in my 'Mikrographie des Holzes' found nothing but an honourable interment.

These conclusions will be found expressed and discussed in the 35 'Notes' underneath. Though they may claim a certain importance of their own, they should preferably be used in connection with the Key, to whose paragraphs I have repeatedly been referring. Here I have to mention a discrepancy between the German and the English edition, of which the numbers do not agree in the following cases: the numbers 238 to 272 inclusive of the English edition correspond to 236 to 270 inclusive of the German version.

If some of the 'Notes' seem to be of little consequence, it has to be remembered that negative results may be as important as positive ones. It is true, though, that some of the 'Notes' of this type are referring to more or less uncertain places in the Key and it should be borne in mind that this uncertainty may as well be due to our lack of knowledge as to a naturally vague gradation of characters.

As will appear, anatomy may reveal relationships which might otherwise easily escape our attention, and has, in fact, not rarely actually done so. In other cases anatomical evidence will throw a new light on supposed relationships based upon other particularly morphological data. Often earlier conclusions will be found confirmed, in other cases they will be weakened and this will necessitate and induce a more critical revision. The combination of anatomical and morphological characters — the latter mostly restricted to the sexual organs — is nothing but a, we hope, felicitous and indispensable approach to the ultimate aim of taxonomy; to complete the typological picture by dealing with all evidence, from whatever quarter, impartially and critically. I think I have done so as far as Anatomy is concerned and I paid especial attention to those cases in which the results obtained through the anatomical method seem to disagree with those which are the outcome of morphological studies. Generally speaking, however, it will be found that the conclusions based upon wood-anatomy agree fairly well with those obtained through morphological methods, though it is my experience that when using wood-anatomical methods the families often seem to split up into more numerous parts than are distinguished on a purely morphological basis.

It will be found that, on account of the working method applied in my 'Mikrographie', the number of species representing a genus or even a family, is mostly restricted to a few. This inevitable feature necessitates special care in drawing conclusions. Attempts have been made to value



the various characters as accurately as possible in each individual case.

Of the 35 'Notes' given below, 29 are the direct outcome of a thorough going through the Key. The first 6 are concerning special cases and may be of some use to make the reader familiar with the nature of my subject. Note 1 deals with the apparent anatomical relationship of the *Meliaceae*, *Sapindaceae*, *Leguminosae* and *Combretaceae* and thus introduces the morphologically trained reader into a world of unexpected vistas. When I had written this first Note, more or less as an effort to marshal my facts and to draw concise conclusions from them, I was struck by the result, as it seemed stimulating and full of promise to me, and I decided to continue. The outcome is embodied in this and the remainder of these Notes. In Note 2 the *Euphorbiaceae* are circumstantially discussed. From a wood-anatomical point of view this family seems to be polyphyletic; the four parts, distinguished by this method, show so little mutual relation that they occur in most different places in the Key. Note 3 yields similar results regarding the *Melastomaceae*; 4 and 5 discuss the phenomenon that allegedly closely related species, when determined on the basis of an anatomical character which is variable within their genus may, in more than one case, be found far apart in the Key, which seems to suggest that they are less closely related than is generally supposed on morphological grounds. On the other hand, it is shown in 5 that a vague distinction between taxa from a morphological standpoint may well correlate with the same sort of conclusion according to wood-anatomy. In 6 a case is discussed of two closely related species which show a considerable difference in their wood anatomy; in 7 it is pointed out that I repeatedly used a combination of characters which is found in a number of families which are very much scattered in e.g. Bentham and Hooker's system, though they are particularly found in the *Calyciflorae*. On the basis of this combination several families are splitting up into two apparently little related parts.

Finally, it may be pointed out that I never went so far as to suggest the creation or delimitation of any taxon on a purely anatomical basis. My taxonomical starting point was the system of taxa of various ranks, created mainly with morphological methods. I merely restricted myself to putting before the reader to whatever corrections of the traditional system wood-anatomy may lead. It is up to the taxonomist to decide which of these he deems worthy of adoption into a system on a broader basis. Not being a systematist I trust that I, fully unbiased myself, have done my duty; and in full confidence I leave it to the taxonomist to take my suggestions for what they are worth and to use them or to leave them alone, as he thinks fit.

I will not conclude these introductory remarks without having tendered my hearty thanks to Dr H. C. D. de Wit, who sacrificed much of his valuable time in looking, with the eye of a modern taxonomist, through the typescript of a wood-anatomist of the old school. I owe him a great debt of gratitude for his kind help and his very able criticism by which I trust that my 'Notes' have considerably gained in clarity of thought and smooth readability.

Names of taxa used in the text have purposely not been 'modernised' so as to maintain the link between the present publication and both my "Mikrographie" and my Keys. My main work has generally been referred to as 'Mikrogr.' or 'Mikrographie' for shortness' sake.

The "Taxonomical Works" referred to in the text are:

Bentham & Hooker, *Genera Plantarum*

Durand, *Index Generum Phanerogamarum*

Engler-Gilg, *Syllabus der Pflanzenfamilien* 7th, 9th and 10th Ed.

Hutchinson, *The Families of Flowering Plants* (Dicotyledons).

### References.

1. MOLL, J. W. und H. H. JANSSONIUS, *Mikrographie des Holzes der auf Java vorkommenden Baumarten*, 6 Vols, 1906—1936.
2. KOOKDERS, S. H. en TH. VALETON, *Bijdragen tot de kennis der Javaansche boomsoorten*, 13 Vols., 1894—1914.
3. JANSSONIUS, H. H., *Anatomische Bestimmungstabelle für die Javanischen Hölzer*. — E. J. Brill Ltd., Leiden 1940.  
It is hoped that an English translation will be published before long.
4. DANSER, B. H., *Typologische en Phylogenetische Systematiek*. — *Vakblad voor Biologen* 21, No. 8, 1940, 137—145.
5. —, *Typologische und Phylogenetische Systematik*. — *Physis* 1, 1942, 52—63.
6. METCALFE, C. R., *The systematic anatomy of the vegetative organs of the Angiosperms*. — *Biol. Reviews* 21, 1946, 159—172.
7. PFLEFFER, J. PH., *De Houtsoorten van Suriname* (1926).

**Note 1.** On the similarity of the wood in some Leguminosae, Combretaceae, Sapindaceae, and Meliaceae.

Ths Nrs 289—299 of the Chief Key comprise 64 species (and varieties) belonging to 4 families. The advanced stage of the Key at which these families are reached, indicated by the high numbers, implies that in their wood-anatomy, they have many characters in common or, in other words, that their wood-anatomy is morphologically similar in many respects. These 4 families are *Meliaceae*, *Sapindaceae*, *Leguminosae*, and *Combretaceae*.

Hutchinson refers *Meliaceae* and *Sapindaceae* as succeeding families to 2 successive Orders, which belong to the same group of related Orders. Engler-Gilg place them in 2 succeeding "Reihen" — 23 and 24 — while Durand arranged *Leguminosae* and *Combretaceae* as families 65 and 74 in two successive cohorts of *Calyciflorae*.

It is evident that in the various systems, based on the usual (macroscopic) morphological characters, the 4 families are not considered to be closely related.

Nrs 289 and 290 of the Chief Key contain only *Meliaceae* (48 spp.).

Nr 299 consists of 2 paragraphs. The first comprises two *Pometia* species (*Sapind.*), *Pometia tomentosa* and *P. pinnata* var. *javanica*. The second paragraph contains *Terminalia teysmannii* (*Combr.*, cf. 592 and Note 35), *Peltophorum ferrugineum*, and *Pithecellobium moniliferum* (*Legum.*, cf. 595 and Note 35). Obviously, these three species, being placed in a single paragraph, resemble each other very closely as regards wood-structure. Their wood-anatomy resembles also greatly that of both the *Pometias* placed in the preceding paragraph of 299. This suggests close

alliance of the two *Leguminosae* and the *Combretaceae* among each other and, in addition, to these Sapindaceous species. I failed to trace in Radlkofer's monograph on *Sapindaceae* (Pflanzenreich, Heft 98) in the descriptions of *Pometia tomentosa* and *P. pinnata* any suggestion of some closer relationship towards *Leguminosae* or *Combretaceae* than was normally accepted in *Sapindaceae*.

In the Chief Key, Nrs 291 to 298 contain only species of *Sapindaceae* and *Leguminosae*. Nr 292 is again subdivided into 2 paragraphs, the first points to *Sapindus rarak* (*Sapind.*), and the second to *Albizzia lebekkoides* and *Albizzia lebbek* (*Legum.*). It is clear that, again, these three species belonging to *Sapindaceae* and *Leguminosae*, are very similar in their wood-anatomy.

These points of contact between *Sapindaceae* and *Leguminosae*, demonstrated in Nrs 299 and 292, are reflected in the Nrs 293 to 298 which contain nothing but sapindaceous and leguminous species in an irregular sequence. Summarizing, it seems that a number of species belonging to the two families, suggest close relationship by their wood-anatomy.

In assessing the amount and weight of the characters common to the 64 species and varieties found under the Nrs 289 to 299, it is necessary to consider the stages to be passed in the Chief Key leading to Nr 289. They are the following: 1b, 5b, 6b, 11b, 12c, 104b, 149b, 155b, 216a, 217b, 223b, 284b, 287b, 289. The accumulation of characters described under these numbers, is the total of characters common to the species entered from Nr 289 to 299.

It was mentioned that the major part of *Meliaceae* (Nrs 289 and 290; 46 spp.) was in this manner allied to the *Sapindaceae* and *Leguminosae* so far discussed, as was *Terminalia teysmannii* (*Combr.*).

Nr 518 has *Cedrela febrifuga* in two varieties (*glabrior* and *velutina*); *Cedrela* belongs to *Meliaceae*. In the second paragraph of 518, reference is made to Nr 519. The first paragraph of 519 and both the paragraphs of 520 have together two *Lumnitzeras* (*Combr.*), *L. coccinea* and *L. racemosa* and a variety, *L. racemosa* var. *pubescens*. This suggests again a possible relationship between *Meliaceae* and *Combretaceae*, now by way of other genera. In Note 30, I will again speak of this evidence. In the current botanical systems, *Meliaceae* and *Combretaceae* are not considered to be closely allied.

Nrs 615 to 623 of the Chief Key contain *Leguminosae* exclusively. *Albizzia lebekkoides* and *A. lebbek* (which we met in the second paragraph of Nr 292) occur again in the second paragraph of 623 next to 3 other *Albizzia* species. Now the second paragraph of 614 leads to the numbers assigned to *Leguminosae* and the first paragraph of 614 has two species of *Terminalia*, viz. *T. bellerica* var. *laurinoides* and *T. bialata*. Again, Nr 614 is reached by way of the second paragraph of 613, and we find *Terminalia javanica* and *T. catappa* in the first paragraph of 613.

I studied the wood-anatomy of 5 *Terminalia* species in total. The fifth, *Terminalia teysmannii* was placed under Nr 299. From the beginning to Nr 614 is a long way which covers 22 Nrs. These are 1b, 5b, 6b, 11b, 12c, 104b, 149b, 155b, 216c, 320b, 345b, 497b, 498b, 516b, 548c,



580b, 581b, 596b, 598a, 607b, 612b, 613b, 614. From the foregoing, it is obvious that these *Leguminosae* and *Combretaceae* resemble each other closely in their wood-structure.

In addition, it is to be observed that *Terminalia bellerica* var. *laurinoides* and *T. bialata* occur again in the first paragraph of 593, and in the second paragraph of that same number *Leguminosae* are placed. The adjacent Nrs 594 and 595 comprise *Albizzia montana*, *Cassia javanica*, *C. fistula*, *C. siamea*, and the 7 *Pithecellobium* species which I examined.

Among the *Pithecellobiums* is to be noted in particular *P. moniliferum*, which had been also placed in 299. All three species of *Cassia* are found under Nr 296, *Cassia javanica* also under 621.

Nr 592 (which precedes Nr 593, viz. 2 *Terminalias* and the family of *Leguminosae*) has *Terminalia teysmannii* (cf. Nr 299) in the first paragraph and *Cassia timorensis* (cf. Nr 296) in the second. The section comprising the Nrs 592 to 595 is reached by way of 1b, 5b, 6b, 11b, 12b, 104b, 149b, 155b, 216c, 320b, 345b, 497b, 498b, 516b, 548c, 580b, 581a, 582b, 583b, 585b, 588b, 591a, 592.

In the taxonomic works consulted for the purpose of this study, no indications were found supporting a relationship among many *Leguminosae* and the greater part of *Terminalia* species as suggested by the similarities in their wood-anatomy. It is, of course, to be noted that the great distance in which Durand, Engler-Gilg, and Hutchinson place *Leguminosae* and *Combretaceae* may be seen as partly due to the inevitable linear arrangement in books treating the vegetable system. These authors, however, do not supply any, or at any rate very slender, evidence of a possible closer relationship than has been generally believed to exist.

Considering now the wood-anatomy of *Leguminosae* and *Sapindaceae*, it is to be observed that *Albizzia tomentella* is placed under Nr 623 in the company of 4 more *Albizzia* species. *A. tomentella* is the sole *Leguminosa* in the first paragraph of 313. Nr 313 is reached by way of the second paragraph of 309, while in the first paragraph of 309, the family of *Sapindaceae* has been placed. Many *Sapindaceae* are arranged under Nrs 310, 311, and 312. The wood-anatomy of *Albizzia tomentella*, therefore, is close to that of many *Sapindaceae*.

*Xerospermum noronhianum* (*Sapind.*) is placed under 298. Nrs 297 and 299 contain *Leguminosae*. Nr 311 contains again *Xerospermum noronhianum*; it is reached by way of the first paragraph of 309 while the second paragraph of 309 leads to the *Leguminosae* of Nr 313 (cf. Note 23).

Nr 563 has *Aphania montana* (*Sapind.*) in the first paragraph. In the second paragraph of this Number and in the two paragraphs of 564, *Bauhinia malabarica* and *Crudia bantamensis* (*Legum.*) occur. This suggests a possible relationship (cf. also Note 34).

Summarising the present Note it may be concluded that the anatomy of the wood of a number of species in *Sapindaceae*, *Combretaceae*, and *Leguminosae* suggests relationship among these families; to a certain extent this also applies to *Meliaceae*! This conclusion finds no support in the arrangement of families in current vegetable systems.

**Note 2.** Possible relationship of Euphorbiaceae with various other families.

When tracing the *Euphorbiaceae* through the Chief Key, it appears that Euphorbiaceous species are inserted 15 times. This high frequency is in agreement with many other general keys, so e.g. in Hutchinson's Key to the Families of Dicotyledons *Euphorbiaceae* occur in 17 places. This suggests a polyphyletic origin of the Family (cf. also Mikrogr. 5, p. 459).

Under Nr 47 of the Chief Key, the genus *Daphniphyllum* is found. Under Nr 49 occur *Daphniphyllum glaucescens* and *D. glaucescens* var. *blumeanum*. The characters mentioned in the Key refer these two species to a group in which all or nearly all division walls of the vessels are provided with scalariform perforations (cf. 1st paragraph of Nr 12), and in which fibre-tracheids are the ground tissue of the wood (1st paragraph of Nr 13). The woods belonging to this group have also two kinds of medullary rays, the first uni-seriate and consisting of upright cells and the second multi-seriate and consisting of simple or composed rays (cf. 1st paragraph of Nr 18).

The woods of *Daphniphyllum glaucescens* and its variety resemble each other very closely. They belong to the group distinguished by me as the fourth, which I found to occur in Javan *Euphorbiaceae* (Mikrogr. 5, pp. 460, 461, 462). I observed that this fourth group showed such wide deviations from the three other groups of the family that, judging by its wood-anatomy only, it had to be seen as of an essentially different nature. I concluded that the wood-structure in this group is the same as e.g. in *Hamamelidaceae* and *Ternstroemiaceae*, a result that was curiously illustrated by Hallier's earlier views (cf. Ueber die Gattung *Daphniphyllum*, ein Uebergangsglied von den Magnoliaceae und Hamamelidaceae zu den Kätzchenblütlern, in Bot. Mag. 18, 1904, 35).

The families or parts of families having the aberrant wood-anatomy just described, are scattered over the whole system (cf. Durand and Bentham & Hooker). They are most numerous among *Calyciflorae*. The wide-spread relationships suggested by the anatomy of their woods, deserve further investigation. The taxa characterized by these characters in the wood are found together in my Key from Nr 12 to 51 incl.

The Javan *Viburnum* species (*Caprif.*) are met with under Nrs 46 and 47 of the Chief Key, in company of some *Eurya* and *Ternstroemia* spp. (*Ternstroem.*). Their places suggest affinity to *Daphniphyllum*.

I have stated concerning *Viburnum* (Mikrogr. 4, p. 9): (transl.) "*Viburnum* is the only genus of *Caprifoliaceae* I have studied. It is the first of the *Gamopetalae*. Its wood-anatomy is close, or even extraordinarily close, to that of several genera of *Polypetalae*, closest of all to *Altingia* and *Distylum* (*Hamamel.*). The wood-anatomy of these three genera is so similar that only slight taxonomic differences seem to be present."

I said later (Mikrogr. 5, p. 462): (transl.) "A new family, *Daphniphyllaceae* consisting of one genus, *Daphniphyllum*, has been accepted by some authors (e.g. Mueller-Arg. in DC. Prodr. 1, 1809, 1; K. Rosenthal, Diss. Breslau, 1916 and Das Pflzr. 68, IV, 147a; and Engler & Prantl, Die Nat. Pflz.fam. 19c, 1931). Miss Rosenthal suggests that the *Daphni-*

*phyllaceae* show close relationship to *Euphorbiaceae*. This is not confirmed by the wood-anatomy."

*Putranjiva roxburghii*, *Cyclostemon subcubicus*, *Aporosa microcalyx*, *A. frutescens*, *A. campanulata*, and *A. arborea* (*Euphorb.*) are placed under the Nrs 57 to 62. Their wood-anatomy is rather similar to *Claoxylon indicum*, *Cyclostemon longifolius*, *C. minahassae*, *Aporosa microcalyx* (!), *Baccaurea racemosa* and *B. javanica*, determined in the Nrs 90 to 95. In Nr 12, these two groups are separated. The first group has scalariform perforations in all, or nearly all, the division walls of the vessels, the second has those walls either with simple or with scalariform perforations and both kinds occur rather frequently. This difference is of slight taxonomical importance but the technique of the Key caused that these two related groups were placed far apart. Their close affinity is also demonstrated by the occurrence of the same genus in both groups (*Aporosa*, *Cyclostemon*). Together these two groups form my third group distinguished in the family of *Euphorbiaceae* (cf. Mikrogr. 5, p. 460). It is to be noted that *Claoxylon indicum* holds a different position, outside group III and is more suitably placed under Nr 483. The wood of *Aporosa microcalyx* is very close to the *Baccaureas* in the Chief Key (cf. Mikrogr. 5, p. 471) and in general the species belonging to the third group resemble each other greatly (cf. l.c., p. 471). I am unable to suggest a relationship to other taxa.

Twenty eight kinds of wood [Nrs 245 (243), 248 (246), 251 (249)—263 (261)] compose the first group of the four I found to exist in *Euphorbiaceae* (cf. l.c., p. 459). The first paragraph of 244 (242) refers to 245 (243), the second to 248 (246).

Nr 245 (243) contains *Cleistanthus sumatranus* (*Euphorb.*) and some *Bixineae*. Nrs 245 (243) and 244 (242) prove that the first group in *Euphorbiaceae* and many *Bixineae* have a related wood-anatomy.

The second paragraph of Nr 245 (243) refers also to Nr 246 (244). In Nr 246 (244) and 247 (245) are found *Bennettia horsfieldii*, *Flacourtia rukam*, *Fl. ramontchi*, *Fl. cataphracta*, and *Scolopia roxburghii*. These species are together the first group of four which I distinguished in *Bixaceae* (cf. l.c. 1, p. 200).

Nr 248 (246) has the first group of *Euphorbiaceae* (excepting *Cleistanthus sumatranus*), and the *Samydaceae*. Summarising these data, it appears that a close resemblance exists among the woods occurring in group I of *Euphorbiaceae* and in *Samydaceae*. The whole of *Samydaceae* (*Homalium tomentosum*, *H. javanicum*, *Casearia flavovirens*, *C. coriacea*, *C. tomentosa*, *C. grewiaefolia*) are met with under Nrs 249 (247) and 250 (248). The wood-anatomy of the *Bixaceae*, of many *Euphorbiaceae*, and of *Samydaceae* seems to suggest a closer relationship among these families than was hitherto suspected (cf. Durand and Benthams & Hooker). Engler-Gilg and Hutchinson refer *Bixaceae* (*Bixineae*) and *Samydaceae* to the same Order, but the *Euphorbiaceae* to another distant Order. One of the "Notes on Affinity" by Hutchinson, when discussing *Euphorbiaceae*, reads (cf. p. 19) "a composite family probably derived from several sources such as *Bixales* etc.". And he places *Bixaceae* and *Samydaceae* (with others) in the Order of the *Bixales*.



The characters of the wood in common to all 28 species can be summarised as follows. All (or nearly all) division walls of the vessels with simple perforations (third paragraph of 12), ground tissue consisting of libriform fibres, all or nearly all septate (first paragraph of 216), these fibres present in only one single kind (second paragraph of 217), the wood-parenchyma sparingly developed or absent (first paragraph of 223), and the vessels without scalariform pitting when in contact with each other (second paragraph of 224).

In this connection I wish to repeat my earlier observations on the subject. Concerning *Euphorbiaceae* I said (l. c. 5, p. 464): (transl.) "The wood-anatomy of the first group of *Euphorbiaceae* resembles very closely that of *Birineae*, *Violarieae* (*Alsodeia*) and the *Samydaceae*. Concerning the *Samydaceae* I said (l. c. 3, p. 611): (transl.) "The microscopic wood-structure of these two genera — *Casearia* and *Homalium* — resemble the structures found in genera of *Bixineae* and *Violarieae* (*Alsodeia*) so closely that, judging by their characters alone, it would seem desirable to bring them to a single family. To this family should be added the first group distinguished in *Euphorbiaceae* or, alternatively, it should be placed in the closest proximity."

The second group of *Euphorbiaceae*, distinguished by me for reason of their wood-anatomy, remains to be considered.

*Cyclostemon longifolius* (cf. l. c. 5, p. 573) has the division walls of the vessels both with simple and with scalariform perforations. The latter are, however, very rare in this species but occur more frequently in the two other species in the genus. This aberrant character causes that *Cyclostemon longifolius* occurs twice in the Key. Its affinity is best expressed under Nr 93, where it stands in company with *Cyclostemon minahassae*; Nr 340, its other place, is less illustrative. *Cyclostemon longifolius* is best referred to the third group of *Euphorbiaceae* (cf. Note 24).

*Claoxylon indicum* (cf. l. c. 5, p. 679) occurs also twice, once under Nr 91 and the second time under 483. In the division walls of the vessels it has simple and scalariform perforations but the latter are much less often occurring. In *C. indicum* var. *gracilius* the scalariform perforations are entirely absent. For this reason, *Claoxylon indicum* is best placed in the second group of *Euphorbiaceae*.

The following is a summary of the characters of the wood-anatomy of this second group. Division walls of the vessels all, or nearly all with simple perforations (third paragraph of 12), ground tissue consisting of libriform fibres (second paragraph of 104), libriform fibres all, or nearly all, non-septate (third paragraph of 216). To these characters to be added that metatracheal wood-parenchymatous layers are present, which are 1 cell thick, if 2 to 4 cells thick nearly always local; the layers at any rate the majority, forming tangential connections among medullary rays (at least 5 rays, usually more; first paragraph of 320).

The second group which I distinguished in *Euphorbiaceae* is probably related, on account of their wood-anatomy, to *Anonaceae*, *Sapotaceae*, *Ebenaceae*, and *Scrophularineae* (cf. foot note l. c. 5, p. 467).

I find no support for this view in current taxonomical systems.

**Note 3.** A subdivision of the *Melastomaceae*.

When considering the places of *Melastomaceae* in the Chief Key, in the manner adopted in Note 2 (*Euphorbiaceae*), it appears that the family is arranged in two groups which are wide apart (Nrs 7, 8 and 220—222).

Their wood-anatomy suggests that the *Melastomaceae* of Java, as a family, are biphyletic.

Nrs 7 and 8 have *Kibessia azurea*, *Memecylon paniculatum*, *M. floribundum*, *M. intermedium*, *M. laevigatum*, *M. oligoneurum*, and *M. excelsum*. Nrs 220, 221, and 222 have *Medinilla javanensis*, *Astronia spectabilis*, *A. macrophylla*, *Melastoma molkenboerii*, *M. setigerum*, *M. asperum*, and *M. lanuginosum*. The two groups correspond entirely to those I have proposed previously (Mikrogr. 3, p. 528, § 2). I then said: (transl.) "The two groups may be distinguished by the following characteristics. In group I, the ground mass of the wood consists of typical fibre tracheids. The wood parenchyma is often rather abundant and the three kinds of tissue are present viz. paratracheal, metatracheal, and diffuse (the diffuse tissue is distributed among the fibre tracheids). Two kinds of medullary rays are easily distinguished; numerous interxylar phloem strands are present.

In group II the ground mass are typical libriform fibres. These fibres show simple pits, are all or nearly all septate and differentiated in two kinds. The wood parenchyma occurs rarely, or very rarely, and usually only paratracheal. Medullary rays present in one single kind, resembling one of the kinds mentioned for group I. Interxylary phloem strands absent.

The following may further stress the differences between the two groups: the genera in each group show only small differences in their wood-anatomy, the species in a single genus very few, if any."

I reject the thought that the wood-anatomy of the two groups might prove less widely and consistently different than has been indicated above. A complex of characteristics of this size and importance never varies to such an extent that truly intermediate forms might be expected to occur. The difference in wood-anatomy between the two groups is so large that I cannot accept them as belonging to one family; they must be seen as belonging to different families.

My conclusion is partly supported by earlier taxonomic views, e.g. such as expressed by A. P. de Candolle, Lindley, Endlicher, Gardner, and Naudin (cf. van Tieghem, Ann. Sc. nat. Série 7, vol. 13, 1891, 23, 24). These authors (except Naudin) unite the genera *Memecylon* and *Mouriria* (not examined by me) into a separate family, placed between *Melastomaceae* and *Myrtaceae*. Naudin's classification (Ann. Sc. nat. Série 3, vol. 12, 1849, 196 and *ibid.* vol. 18, 1852, 85, 257) is followed by Miquel (Fl. Ind. Bat. 1, 1855, 498); they keep *Kibessia* and *Astronia* apart.

More recent taxonomists (e.g. Krasser in Engl. & Prantl III, 7, 1898, 143; Cogniaux in Durand, Index Generum, 1888, 130; and Bentham & Hooker, Gen. Pl. I, 1867, 725) hold an opinion entirely different from my own. They bring *Kibessia* and *Astronia* into the same section.

R. C. Bakhuizen van den Brink Jr wrote the most recent revision of Malaysian *Melastomaceae* (cf. Bijdr. Kenn. Melast. Mal. Arch. Ned. Ind., Diss. Utrecht, 1943, 31 pp., and Contr. Knowl. Melastom. Mal. Arch. Neth. Ind. in Rec. Trav. Bot. Néerl. 40, 1943—45, 1—391).

Bakhuizen, like many others before him, tried to separate the *Memecyloideae* from the rest of the family but failed; intermediate forms appeared to exist. He felt also obliged to refrain from a combination of *Memecyloideae* and *Tamoneae*. Bakhuizen concluded that the *Melastomaceae* are a natural group, belonging to *Myrtales*, and consisting of three distinct sub-families. His results, derived from the usual characteristics guiding taxonomical research, are different from mine, founded on the study of wood-anatomy.

Finally I wish to repeat my earlier conclusion (Mikrogr. 3, p. 530, 2): (transl.) "Authors who examined the anatomy of *Melastomaceae* like Van Tieghem and Solereder confirm by their results my observations. Van Tieghem (Ann. Sc. nat. Série 7, vol. 13, 1891, 23) divided the family into two "divisions". The first contains *Memecylon* and *Kibessia*, the second *Astronia*, *Melastoma*, and *Medinilla*. He has no wish to raise these "divisions" to family rank (cf. l. c., p. 90)."

**Note 4.** The consequences of the use of an unstable wood-anatomical character.

Sometimes species are closer related than might be expected when considering their places in the Chief Key. Notes 4 and 5 have been written in order to illustrate the point. Some Euphorbiaceous species are first of all to be considered.

Under Nr 12 the woods are separated into three groups according to the following wood-anatomical characters. Firstly: division walls of the vessels all, or nearly all, with scalariform perforations, secondly: division walls of the vessels all, or nearly all, with simple perforations, and thirdly: division walls of the vessels with simple or scalariform perforations and both kinds of perforations usually at least numerous.

It has appeared, during my wood-anatomical studies, that this distinction occasionally is of slight taxonomic value. It seems, now and again, that the distinction on this account, is not a very marked one. Some Euphorbiaceous species, of a single genus and closely related to each other, are placed far apart in the Chief Key solely because of their belonging to different groups whereas these groups are rather artificial.

Nr 483 has, in the first and second paragraphs, *Claoxylon indicum* and *Claoxylon indicum* forma *gracilius*. Nevertheless, *Claoxylon indicum* would be placed in the first paragraph of Nr 91, if it were referred to the third group just indicated above. I have indicated (Mikrogr. 5, p. 674—684) that *Claoxylon indicum* and *C. indicum* forma *gracilius* in their woods resemble each other closely. J. J. Smith (in Koorders & Valetton, Bijdr. Kenn. Booms. Java 12, 1910, 371, footnote) points to a wide variability in general (cf. bottom of p. 468, Mikrogr. 5).

There are three *Cyclostemon* species inserted in the Key. *C. longifolius* is placed in the first paragraph of 93 and in the first paragraph of 340,



*C. minahassae* in the second paragraph of 93 and *C. subcubicus* in the second paragraph of 59 (cf. Note 24). Their situation, so widely apart, is caused only by the division made under Nr 12. It is to be remembered that I have pointed to the close similarity of their woods (Mikrogr. 5, p. 470). In "Das Pflanzenreich" (no. 81, p. 234) we meet with these three species in the same section (Sectio *Sphragidia*). J. J. Smith (Bijdr. Kenn. Booms. Java 12, 1910, 200) remarked that the Javan species of *Cyclostemon* probably belong all to Sectio *Eucyclostemon* Muell.-Arg.

Similar cases may be traced in *Casuarina*, *Dehaasia*, *Litsea*, *Marlea* and *Vaccinium*, and further as regards different wood samples of *Iteadaphne confusa*.

**Note 5.** The aberrant wood-anatomy of *Grewia microcos* (Tiliac.).

Under Nr 153 of the Chief Key is found *Grewia microcos*. The other species of the genus *Grewia*, as represented in Java, are met with in 450 and 451. They are *G. celtidifolia*, *G. excelsa*, *G. eriocarpa*, *G. laevigata*, and *G. laevigata* var. *oblongifolia*. It might be assumed (cf. Note 4) that *Grewia microcos* is very different from the rest of the genus.

Tile cells occur in the medullary rays of *Grewia microcos* and are wanting in the other species of *Grewia* (and the variety). This is the only reason for the separation of *G. microcos* in the Key (cf. the remark on tile cells in Note 16 and also Note 28).

Tile cells (in the medullary rays) I found only in 7 species of trees occurring in Java. These 7 species belong to 3 families (*Malvaceae*, *Sterculiaceae*, and *Tiliaceae*) which are so closely related that several (particularly French) taxonomists considered them to as one single family, the other school keeps them in one Order. My results support the former view.

In the Chief Key, the 7 woods having tile cells are placed consecutively in 150—154. It might be believed, therefore, that the presence of these tile cells points to a close relationship. On the other hand, many species, the majority in fact, in these families have no tile cells in the medullary rays.

In *Grewia* I examined 5 species (and one variety in one of these). Of the other genera having species with tile cells, I only studied one species each. This makes comparison very nearly impossible.

The cells in the medullary rays of *Grewia microcos* are, moreover, no typical tile cells. In the medullary rays of *G. laevigata* cells are found which are different from the regular cells and resemble more or less tile cells. These aberrant cells are absent in its variety *oblongifolia*. It seems for these reasons that the isolated position of *Grewia microcos* is greatly overstressed and that its affinity to the rest of *Grewia* is closer than suggested in the Key (for further information cf. Mikrogr. 1, pp. 508, 510, 511).

The wood-anatomy of *Grewia microcos* provides no sufficient reasons to place it into another genus.

My conclusion after study of the wood-anatomy of *Tiliaceae* was (Mikrogr. 1, p. 481, § 2) that four groups ("divisions") might be disting-

nished. *Schoutenia buurmanni* and *Columbia javanica* were placed in "division b", together with *Grewia microcos*. The remainder of the genus *Grewia* was set apart as "divisions c and d". This might be used as an argument in favour of referring *G. microcos* to another genus. I wish to repeat that the wood-anatomy of *G. microcos* is no more different from the other species of *Grewia* than that of *G. laevigata* from *G. laevigata* var. *oblongifolia* ("division d"), and that existing among the *Grewia* species of "division c".

Miss M. Chattaway, on the strength of her study of the tile cells in the medullary rays of the *Malvales*, refers *Grewia microcos* to the genus *Microcos*, apart from *Grewia* (Trop. Woods 38, 1934, 9 and New Phytologist 32, 1933, 261—273). F. Kukachka and L. W. Rees arrive at the same conclusion for similar reasons (Agric. Exp. Sta. Univ. Minnesota Techn. Bull. 158, 1943 and Trop. Woods 84, 1943, 35).

Linnaeus established both the genera *Grewia* and *Microcos*; he later on united them (as *Grewia*). Nearly all taxonomists shared his final decision. M. Burret maintains *Microcos* and *Grewia* as separate genera (Notizbl. Bot. Gart. Mus. Berlin-Dahlem 88, vol. 9, 1926, 592—880). Burret found that *Grewia microcos* L. (Syst. ed. XII, 2, 1767, 602) is identical with *Microcos paniculata* L. (cf. l.c., p. 733) and that *Microcos paniculata* L. is the type species of *Microcos* (l.c., p. 757).

Schumann (in Engler & Prantl III, 6a) treats only *G. excelsa* and *G. microcos* and places each of them into a different subgenus. Burret places *G. laevigata* into another section of the genus *Grewia* than *G. celtidifolia*, *G. excelsa*, and *G. eriocarpa*.

It seems, that the opinions regarding the taxonomy of *Grewia* and allied groups are not settled. My study in their wood-anatomy has brought me to the decision that *Grewia microcos* holds no isolated position apart from the other species of *Grewia*.

**Note 6.** The wood-anatomy of Javan *Schoutenia* (Tiliac.).

Among the Javan species of *Schoutenia* (Tiliac.), I examined *S. ovata* and *S. buurmanni*.

Koorders & Valetton (Bijdr. Kenn. Booms. Java 1, p. 210) described *S. buurmanni* for the first time. No striking differences are mentioned between *S. ovata* and the new *S. buurmanni*. Heyne, discussing the economic properties of the species (Nutt. Pl. Ned. Ind., 1927, 1021, sub *Actinophora fragrans* R. Br. and *A. buurmanni* Kds) also mentions no wide difference nor does Burret, from a taxonomical point of view (Notizbl. Bot. Gart. Berlin-Dahlem 88, 9, 1926, 626, 627).

I found, however, a great difference in the wood-anatomy of these two species. It was even necessary to describe each wood in detail and separately instead of referring the second description to the first, as was usually possible when describing several species in one genus (cf. Mikrogr. 1, pp. 521, 523).

Their greatly different wood-anatomy caused that the two *Schoutenias* occupy now in the Chief Key widely separate places. *S. ovata* is found under Nr 475 (second paragraph) and *S. buurmanni* under Nr 379 (second paragraph).

By way of 17 numbers, *S. buurmanni* is reached in the Key; *S. ovata* required 21 numbers. They have the first 12 numbers in common (cf. Note 26 for *S. buurmanni* and Note 28 for *S. ovata*).

This peculiar state of affairs is illustrated by a remark made previously (Mikrogr. 1, p. 483, end of § 2) when I discussed relationships among *Tiliaceae*: (transl.) "According to this classification, the species of *Grewia* and *Schoutenia* are distributed over two "divisions" and mingled with species of other genera; I find this here (end of volume 1) for the first time, till now, the species of one genus always showed a closer resemblance to each other than to any species of another genus."

**Note 7.** Fibre tracheids and scalariform perforations and their correlation with the medullary rays (Notes 7—12).

Nrs 14 to 52 of the Chief Key contain 75 kinds of wood referable to 12 different families. These are: *Celastrineae*, *Cornaceae*, *Oleaceae*, *Styracaceae*, *Ternstroemiaceae*, *Dilleniaceae*, *Saxifragaceae*, *Staphyleaceae*, *Caprifoliaceae*, *Hamamelidaceae*, *Vacciniaceae*, and *Euphorbiaceae*. Five of these families are represented by one genus only, viz. *Elaeodendron* of the *Celastrineae* (*E. glaucum* and *E. glaucum* var. *macrocarpum*), *Turpinia* of the *Staphyleaceae* (*T. pomifera* and *T. parva*), *Viburnum* of the *Caprifoliaceae* (*V. sambucinum*, *V. sundaicum*, *V. sundaicum* var. *latifolia*, and *V. coriaceum*), *Vaccinium* of the *Vacciniaceae* (*Ericaceae*) (*V. lucidum*), and *Daphniphyllum* of the *Euphorbiaceae* (*D. glaucescens* and *D. glaucescens* var. *blumeum*). As regards Miss K. Rosenthal's family of *Daphniphyllaceae*, see Note 2.

The 75 kinds of wood appear to have the following characters in common: the division walls of the vessels have all, or nearly all, scalariform perforations (Nr 12, first paragraph), and the ground mass is composed of fibre tracheids (Nr 13, first paragraph). These two characters occur in the majority of the 75 species in correspondence with some other characters. I have pointed out (Rec. Trav. Bot. Néerl. 28, 1931, 104) that: (transl.) "In families having the ground mass of the wood consisting of fibre tracheids, nearly all division walls of the vessels have scalariform perforations at the same time. In addition, the wood parenchyma is usually scattered among the fibre tracheids and the medullary rays occur in two kinds. The first kind is uni-seriate and the second consists for the greater part of typical compound medullary rays (cf. Mikrogr. 3, p. 304, sub *Hamamelidaceae*). The wood of these families is therefore distinctly different from that of all other families and they occur scattered at various places in the system of Bentham and Hooker, particularly among the *Calyciflorae*." Many authors (in particular American) consider them to be primitive. A recent publication on this subject is by O. Tippe (Am. Midl. Nat. 36, 1946, 362—372, and Trop. Woods 89, 1947, 66).

I offer at present no explanation for the occurrence of this wood-structure in so many families, recurring at widely different places in the system. Further research may throw a new light on this problem.

When consulting the literature mentioned above, it becomes clear that a "storied" structure ("ripple-marks") is never met with in these families.



I have commented on this before (Mikrogr. 5, p. 461) and stated concerning the two species of *Daphniphyllum* (*Euphorb.*): (transl.) "(Group IV of this family is formed by *Daphniphyllum glaucescens* and *D. glaucescens* var. *blumeanum*. This group is so significantly different from the three other groups in this family as regards its wood-anatomy, that it cannot possibly belong to the same family."

In group IV the ground mass of the wood consists of fibre tracheids, all the division walls of the vessels have scalariform perforations, bundles of vessels occur nearly always rarely, metatracheal wood parenchyma is entirely wanting and the members of the vessels are longer than in the three other groups. This group IV shows the same wood-structure as found in a considerable number of other families, e. g. in *Hamamelidaceae* (cf. Hallier, Bot. Mag. 18, 1904, 35) and in *Ternstroemiaceae*.

In this connexion a note on *Viburnum* (*Caprifol.*) is of importance, made on page 9 of the Mikrogr. 4 (cf. also Note 12).

For these reasons, the wood-anatomy of the species referred to above is strikingly similar in many respects. Is there a closer relationship among these families than was hitherto suspected? They have in the Chief Key in common Nrs 1b, 5b, 6b, 11b, 12a, 13a, and 14, i. e. only seven numbers and this might suggest only a limited, not a very close, resemblance.

In the current taxonomic works, only now and then some evidence points to a closer relationship among the species and families under discussion, but these facts and views are not all in agreement with my findings nor among each other. In Notes 8 to 12, I intend to discuss the problem more fully.

#### **Note 8.** Affinities among Olacineae, Styracaceae, and Symplocaceae.

Nr 20 in the Chief Key consists of two paragraphs. In the first paragraph are placed three species of *Platea* (*Olac.*): *Platea latifolia*, *P. excelsa*, and *P. parvifolia*. They resemble each other closely in their wood-anatomy. The second paragraph contains the only species of *Bruinsmia* (*Styrac.*) I examined: *Bruinsmia styracoides*.

Being placed under one number and side by side, it is clear that the four species suggest to be allied. Nr 20 is still in the beginning of the Key and is reached by 1b, 5b, 6b, 11b, 12a, 13a, 14b, 15b, 16b, 17b, 18a, 19a; a way which does not stress in particular a close relationship among them.

In the current taxonomic works little or nothing points to a closer affinity, but Hutchinson, in the "Notes on Affinity" (p. 24), said that the *Styrales* (Order 63) are: "A small group probably most closely allied and finding its origin in the *Olacales*."

A possible relationship between these two families was suggested by me (Mikrogr. 2; p. 215 and 4, p. 471) when I remarked (foot-note vol. 4, p. 480): (transl.) "The structure of the wood in this family (*Styracaceae*), in particular as regards the genus *Symplocos*, resembles very closely that found in many other families such as *Ternstroemiaceae*, *Saxifragaceae*, *Hamamelidaceae*, and e. g. the genus *Platea* of *Olacineae*." I continued later on: (transl.) "Bentham & Hooker (Genera Pl. 2, p. 667) wrote:

— Ordo (*Styracaceae*) inter Gamopetalos Sapotaceis et Ebenaceis prae aliis accedit, pluribus notis tamen ab utroque depellitur. A nonnullis cum Ternstroemiaceis, Meliaceis v. etiam Olacineis comparatur, sed affinitas, si adest, valde remota apparet. — Attention should be paid to the fact, that according to their wood-structures the *Meliaceae* and the *Styracaceae* are not related."

A. Brand (Das Pflzr. 6, 1901) treated *Symplocos* as a separate family. When discussing affinities (Verwandtschaftliche Beziehungen, p. 11) he said: (transl.) "The nearest relations of the *Symplocaceae* are the *Styracaceae*, which follow in the system. They are still often united with the *Styracaceae* to one family. They are different from the *Styracaceae*, however, by characters of such importance that a splitting into two families seems warranted."

**Note 9.** The genus *Saurauja* (Ternstroem.) and the *Dilleniaceae*.

The genus *Saurauja* (Ternstroem.) is found in the Nrs 22, 23, and 24 of the Chief Key. The *Dilleniaceae* are placed under Nrs 22, 25, and 26; *Saurauja* and *Dilleniaceae* have Nr 22 in common.

This arrangement suggests close relationship. On the other hand, Nr 22 is only at the beginning of the Key and soon reached, which is not illustrative for a possible close affinity.

In the usual taxonomic works very different opinions are expressed as regards relationship between *Ternstroemiaceae* and *Dilleniaceae*. Durand assigned the *Ternstroemiaceae* to "cohors" 5 and the *Dilleniaceae* to "cohors" 1 of the *Thalamiflorae* (*Polypetalae*). Engler-Gilg (Syllabus, 9th and 10th ed.), while including *Saurauja* in *Actinidiaceae*, inserted the *Dilleniaceae* and the *Actinidiaceae* both in the first "Unterreihe" of the *Theineae*, which form part of the "Reihe" 27 in the *Parietales*. This is further confirmed in Engler & Prantl (Nat. Pfl.fam. 21, 1925).

Hutchinson refers the *Sauraujaceae* (fam. 113) to Order 32 (*Theales*) and the *Dilleniaceae* (fam. 85) to Order 24 (*Dilleniales*). In his "Notes on Affinity" (p. 17) he remarked, however, regarding the *Theales*: "Related to *Dilleniales* and *Bixales*", and a little earlier (p. 15), regarding the *Dilleniales*: "perhaps indicating the origin of the *Theales* and other families."

As a final quotation, I add (Mikrogr. 1, p. 287): (transl.) "It is worthy of note that Gilg in Engler & Prantl (1st ed., III, 6, p. 126) places *Saurauja* with the *Dilleniaceae*. In general, the wood-anatomy of the *Dilleniaceae* and the *Ternstroemiaceae* show a more or less close resemblance. Moreover, all wood of *Saurauja* has raphide cells scattered among the parenchyma cells and in this concurs with *Dilleniaceae* which have, contrary to *Ternstroemiaceae*, raphide cells. On the other hand, the wood of *Saurauja* resembles more closely the wood of *Ternstroemiaceae*."

**Note 10.** *Turpinia* (Staphyl.), *Symplocos* (Styrac.), *Ternstroemiaceae*, *Saxifragaceae*, and *Caprifoliaceae*.

Nr 32 of the Chief Key has *Turpinia pomifera* and *T. parva* (Staphyl.). These two species resemble each other closely in their wood-anatomy. The

second paragraph of Nr 32 has a reference to Nr 33. In the first paragraph of 33, the genus *Symplocos* (*Styrac.*) and several *Ternstroemiaceae* (cf. 36 and 37) are placed, while in the second paragraph the genus *Eurya* (*Ternstroem.*) and several *Saxifragaceae* are met with. The *Saxifragaceae* are *Itea macrophylla*, *I. macrophylla* var. *minor*, *Polyosma mutabilis*, *P. integrifolia*, *P. integrifolia* forma *subdenticulata*, *P. ilicifolia*; in the same paragraph is also *Viburnum sambucinum* (*Caprifol.*).

It would seem that some relationship exists among these families and species, judging by their position in the Key.

In addition, in the first paragraph of Nr 30, *Styrax benzoin* (*Styrac.*) is placed, and in the second paragraph a reference is made to Nr 31 where, in the first paragraph, *Weinmannia blumei* (*Saxifr.*) is found and in the second paragraph reference is made to Nr 32.

On the other hand, all these numbers are still in the initial stages of the Key, and by way of only 18 preceding numbers our present group is reached. This allows no conclusion intimating a close resemblance.

In the usual taxonomic works, I hardly find any indication towards a closer relationship as is suggested by wood-anatomical characters.

Of *Staphyleaceae* I examined only 2 *Turpinia* species. These resembled each other very closely as regards their wood-anatomy and show no affinities to one of the other four families discussed here (cf. Mikrogr. 2, p. 416, foot-note)! I pointed out, however, that there was relationship with *Celastrineae*, and *Celastrineae* comprise *Elacodendron*, a genus belonging to the related groups considered in these Notes (cf. Note 7, and Nr 14 of the Chief Key).

Of *Symplocos* I examined 10 kinds of wood. I concluded (l.c. 4, p. 480, foot-note): (transl.) "The wood-structures met with in this family (*Styraceae*), especially in *Symplocos*, resemble greatly those found in many other families, such as *Ternstroemiaceae*, *Saxifragaceae*, *Hamamelidaceae* and e.g. the genus *Platea* (*Olacineae*)."

My conclusion was cited in Note 8, where I added Benthams & Hooker's views on the relationships existing in this group and also A. Brand's opinions. To these I add what I have said in a foot-note in the "Mikrographie" (vol. 3, p. 307) that the species of *Hamamelideae* I examined (*Distylium stellare*, *Altingia excelsa*, *A. excelsa* var. *velutina*) seem to be closely related to the genera *Itea* and *Polyosma* (*Saxifr.*). When discussing the *Ternstroemiaceae* (l.c. 1, p. 282) and the *Saxifragaceae* (l.c. 3, p. 264) I suggested no affinities to any other families.

Of *Caprifoliaceae* I examined *Viburnum sundaicum*, *V. sundaicum* var. *latifolia*, *V. coriaceum*, and *V. sambucinum*. I concluded (l.c. 4, p. 9, foot-note): (transl.) "*Caprifoliaceae* are the first family of *Gamopetalae*. *Viburnum* is the only genus I studied. It is closely, one might say extremely closely, related to several families of *Polypetalae*. Closest is this relationship with *Altingia* and *Distylium* (*Hamamelideae*). The wood-anatomy of these three genera is so nearly identical, that only differences of very slight taxonomical value seem to be present."

Finally I note that *Nyssa* and *Mastixia* (*Cornaceae*, the final family of *Polypetalae*) are in their wood characters also closely related to *Viburnum*. *Mastixia* and *Nyssa* occur in Nrs 15 and 16 of the Key.



**Note 11.** Hamamelideae, Vacciniaceae, and Ternstroemiaceae.

Nr 42, first paragraph, has *Altingia excelsa* and *A. excelsa* var. *velutina* (Hamamel.). These two kinds of wood resemble each other very closely (cf. also Note 7). The second paragraph contains a reference to Nr 43.

Nr 43 (first par.) has *Vaccinium lucidum* (Vaccin.) and the second paragraph has *Distylium stellare* (Hamamel.) and several *Ternstroemiaceae*. The latter, which occupy also Nrs 44 and 45, are *Pyrenaria serrata*, *P. lasiocarpa*, *Haemocharis integerrima*, *Camella lanceolata*, and *Gordonia excelsa* var. *macrocarpa*.

I have pointed out before that the wood-anatomy of *Altingia* and that of *Distylium stellare* are closely alike (Mikrogr. 3, p. 307).

The manner in which these three families occur under the two Nrs 42 and 43 suggests a close resemblance of their woods and so a definite relationship. On the other hand, by way of 17 numbers only, this stage of the Key is reached and this is no strong evidence for a near affinity.

The current taxonomical works suggest little in support of affinity. I noted (Mikrogr. 5, p. 461) when dealing with *Daphniphyllum*: (transl.) "*Daphniphyllum* woods show the same structure as found in a large group of other families, including e.g. *Hamamelideae* and *Ternstroemiaceae*." Further reference to the question is made in Notes 7 and 10.

**Note 12.** *Viburnum* (Caprif.) and *Daphniphyllum* (Euphorb.); their relationships to Hamamelideae and Ternstroemiaceae.

Nrs 46 (first paragraph) and 48 of the Chief Key contain the 5 species of *Viburnum* (Caprif.) I have examined.

The second paragraph of Nr 46 has a reference to Nr 47. In the first paragraph of Nr 47, *Daphniphyllum* (Euphorb.) is placed. The two species I studied are found under Nr 49.

The second paragraph of 47 comprises the genera *Eurya* and *Ternstroemia* (*Ternstroem.*); their species are placed in 50 and 51.

It appears that these groups are closely interwoven, at least when judging by their wood-anatomy. Nevertheless, by way of only 17 numbers the group is reached and this offers insufficient evidence for their relationship among each other. Nothing in current taxonomic works points to a closer affinity than was assumed to exist hitherto.

I have discussed before (Note 10) the resemblance of the wood of *Viburnum* (Caprif.) to *Altingia* and *Distylium* (Hamamelid.). The affinity of *Daphniphyllum* (Euphorb.) was remarked on in Notes 2 and 7; there appeared to be a link with *Hamamelideae* and *Ternstroemiaceae*.

It is finally to be noted that Nr 41 of the Chief Key refers to the species and families treated in Note 11, and that Nr 41 has also (in its second paragraph) a reference to the species and families treated in Note 12. I hold that the wood-anatomy of the groups dealt with in these present Notes 7—12 suggests that several phylogenetic affinities exist as yet unaccounted for by the commonly accepted systems.

**Note 13.** Scalariform perforations and a libriform fibrous ground mass.

The groups contained in the Nrs 52 to 81 in the Chief Key, have woods in which the division walls of the vessels show all, or nearly all, scalariform perforations (Nr 12, first paragraph), while libriform fibres compose the ground mass (Nr 13, third paragraph).

Nrs 52 to 81 house 45 kinds of wood, which belong to 14 families. These families are *Sabiaceae*, *Olacineae*, *Cornaceae*, *Euphorbiaceae*, *Magnoliaceae*, *Myristicaceae*, *Myrsineae*, *Saxifragaceae*, *Celastrineae*, *Bixineae*, *Monimiaceae*, *Rhizophoraceae*, *Araliaceae*, and *Violariaceae*. Several of these families are represented by one genus only.

These are *Sabiaceae* (by *Meliosma*, 6 species), *Olacineae* (by *Strombosia membranacea*), *Cornaceae* (by *Marlea javanica*), *Myristicaceae* (by *Myristica*, 8 species), *Myrsineae* (by *Muesia forbesii*), and *Celastrineae* (by *Caryospermum serrulatum*).

Nrs 52 to 81 are reached by way of 1b, 5b, 6b, 11b, 12a, 13b, 52. This means that only the added characters of 7 Nrs mark their woods but are insufficient to illustrate their close affinity.

In the current taxonomic works here and there some data are found more or less in support of my findings. It is to be noted, however, that the various authors are not in agreement concerning certain points.

*Strombosia membranacea* (Olacin.) and *Marlea javanica* (Cornac.) occupy the first and second paragraph of Nr 56. I find nowhere any datum in support of a close relationship between the two. The only fact of possibly some significance is that *Marlea javanica* holds a somewhat isolated place in the genus having plates of scalariform perforations in the division walls of the vessels (cf. Note 28).

Seven species of *Magnoliaceae* are placed in Nr 63 (first paragraph). The same number (second paragraph) holds 8 species of *Myristicaceae*. There seems to exist a link between *Magnoliaceae* and *Myristicaceae*.

Durand indicated no closer relationship than was accepted so far. Engler-Gilg place the families in the same "Unterreihe" of "Reihe" 18 (*Ranales*). Hutchinson refers the *Magnoliaceae* as the first family to the *Magnoliales* (Order 1) while the *Myristicaceae* are the third family of the *Laurales* (Order 3); both Orders belong to a group of rather closely related ones.

The systems proposed by these authors have the *Monimiaceae* also close to both *Magnoliaceae* and *Myristicaceae*, or to *Myristicaceae* only. In *Monimiaceae* I only examined 2 species of *Kibara* (placed in Nr 79, first par.). I made no suggestion towards a possible relationship among these families in my "Mikrographie".

Nr 77 (first par.) has *Caryospermum serrulatum* (Celastrin.) and the second paragraph has *Bergsmia* (*Hydnocarpus*) *sumatrana* and *Taractogenos blumeana* (*Bixineae*). Their places, close together, again suggest relationship but I found nowhere any opinion expressed in support of this result of the study of their wood-anatomy. The same position exists regarding the four species of *Bruguiera* (*Rhizoph.*) and *Horsfieldia aculeata* (*Araliaceae*) placed side by side in Nr 80, the two species of

*Rhizophora* (*Rhizoph.*) and *Alsodeia cymulosa* (*Violac.*) placed under Nr 81.

**Note 14.** Simple and scalariform perforations in the division walls of the vessels in connection with fibre tracheids and libriform fibres.

Nrs 82 to 103 in the Chief Key comprise a number of groups which have both simple and scalariform perforations in the division walls of the vessels, and both to a considerable amount (Nr 12, second par.). Nrs 83 to 88 have the wood characterized by a ground mass consisting of fibre tracheids (Nr 82, first par.) and Nrs 89 to 103 have a ground mass of libriform fibres (Nr 82, second par.).

Nine kinds of wood are contained in 82 to 88, belonging to *Rubiaceae*, *Vacciniaceae*, *Myricaceae*, and *Casuarinaceae*. Twenty one kinds of wood are contained in 89 to 103, belonging to *Laurineae*, *Euphorbiaceae*, *Birineae*, *Myrsineae*, and *Araliaceae*. The families are often represented by a single genus.

The group 82—103 is reached by way of 6 numbers only, which is not an adequate stress on the similarity of the wood-anatomy in these species.

The current taxonomic works, again, contain but few data in support of any closer relationship among the groups under discussion; opinions also vary. During my previous study in wood-anatomy I myself have made no remark on the subject.

Nr 84 (first par.) has *Lasianthus purpurea* and *Lasianthus spec.* (*Rub.*). The second paragraph has four species of *Vaccinium* (*Vacc.*). For this contact between *Rubiaceae* and *Vacciniaceae* I have no suggestion to offer, neither from literature nor from my own earlier work. It is to be noted that the species of *Lasianthus*, on account of their wood-anatomy, hold a somewhat isolated position from the rest of *Rubiaceae* (cf. Mikrogr. 4, p. 35).

Nr 87 (first paragraph) has *Myrica javanica* (*Myric.*). The second paragraph contains two species of *Casuarina* (*Casuar.*). Is there in reality a close relationship as is suggested by their adjacent position in the Chief Key?

Durand places *Myricaceae* and *Casuarinaceae* immediately together, and in the same Series. Engler-Gilg keep them not far apart but assign them to different "Reihen". Hutchinson keeps them relatively close together but refers them, nevertheless, to different Orders (*Myricales*, 46, and *Casuarinales*, 49) though still belonging to one related group. I myself mentioned no supporting data towards a relationship before. A perusal of the Chief Key further shows that the groups placed in 83—88 are closely interwoven if judged only by the evidence supplied by their wood-anatomy.

I examined the wood of 65 kinds of *Laurineae*. A general character is the presence of oil and mucilage cells. The following 9 kinds are without them: *Iteadaphne confusa*, *Cryptocarya densiflora*, *Lindera bibracteata*, *Litsea chinensis*, *L. chinensis* var. *littoralis*, *L. citrata*, *L. diversifolia*, *L. tomentosa*, and *Actinodaphne macrophylla* var. *angustifolia*. Of these exceptional woods are placed in Nr 100, first paragraph *Iteadaphne con-*



*fusa*, *Litsea diversifolia* and some other *Laurineae*. In the second paragraph are found the two *Macropanax* species I studied and the seven *Heptapleurums*, all *Araliaceae*. This point of contact between the two families cannot be explained in the light of any opinion expressed in the current taxonomic works; I myself have no further evidence in favour of a close relationship to offer.

**Note 15.** Simple perforations in the division walls of the vessels in correlation with fibre tracheids.

Nrs 104 to 148 have a group of woods distinguished by simple perforations in all, or nearly all, division walls of the vessels (Nr 12, third par.) while fibre tracheids compose the ground mass of the wood (Nr 104, first par.).

The group is composed of 78 kinds of wood, belonging to 10 families viz. *Celastrineae*, *Vacciniaceae*, *Casuarinaceae*, *Rhizophoreae*, *Olacineae*, *Myrtaceae*, *Rubiaceae*, *Rosaceae*, *Polygaleae*, and *Apocynaceae*.

Only 6 numbers form the way by which this group in the Chief Key is reached. This is too little stress on the similarities in reality existing among these species.

The usual taxonomic works present but few data pointing to a closer relationship among the species and families than was believed to exist hitherto; opinions also are not quite in agreement.

In the first paragraphs of 6 numbers between 104 and 149 one or more species of one family occur whereas all second paragraphs of these numbers contain one or more species of another family. In each case, this may indicate some relationship between such families. Only in one of these six cases, I am able to throw some more light on the problem; the other five remain without further comment at present as there are no supplementary data available from literature.

Nr 125 (first par.) has *Ochrosia salubris* and *O. ackeringae* (*Apocyn.*); the second paragraph contains many *Rubiaceae*.

This might point to a relationship between *Apocynaceae* and *Rubiaceae*. Durand and Engler-Gilg offer very little, if anything, in support of this. Hutchinson takes *Apocynaceae* as family 230 to belong to the 65th Order (*Apocynales*) and *Rubiaceae* as family 232 to the 66th Order (*Rubiales*); these Orders belong to different groups.

Now under Nr 119, *Hymenodiction excelsum* (*Rubiaceae*) is separated from *Rauwolfia sumatrana* and *R. reflexa* (*Apocyn.*). I noted (Mikrogr. 4, p. 572) that *Rauwolfia* and *Ochrosia*, both genera of *Apocynaceae*, may be seen as a small group separate from the remainder of *Apocynaceae*. I made no suggestion, however, that this small group would be closely related to *Rubiaceae*.

In three non-consecutive numbers in the present group (104—148), a genus of *Celastrineae* is met with, being 106, 108, and 112. This is better understood when considering what was said earlier (Mikrogr. 2, p. 262: (transl.) "I found that the woods of the 6 genera of *Celastrineae* which I studied, differ from each other more than is anywhere found in the preceding families."

*Rubiaceae* are placed in 4 numbers: *Mussaenda frondosa* in 115, *Hymenodiction excelsum* in 119, two genera and several species in 122, and in 125 a large number of species.

I wish to leave it at this. For the moment it must suffice to have pointed to the possibilities arising from the arrangement in the Chief Key.

**Note 16.** Relationship of *Malvaceae*, *Sterculiaceae*, and *Tiliaceae*; their tile cells.

The section of the Chief Key comprising Nrs 149 to 154 has seven kinds of wood belonging to three families, viz. *Malvaceae*, *Sterculiaceae*, and *Tiliaceae*. They have tile cells in the medullary rays (Nr 149, first paragraph).

Seven numbers lead to this section of the Chief Key, and this does not accentuate the very close resemblance existing in the anatomy of these woods. The wood-anatomy actually strongly points to a near affinity.

This conclusion is supported by the current taxonomic systems. Durand joins them as "Cohors" 6 of the *Malvales* (*Thalamiflorae*). Engler-Gilg bring the 7 kinds of wood to the same "Unterreihe", the *Malvineae*, of "Reihe" 26 (of the *Malvales*). Hutchinson unites them in one Order (*Tiliales*, Order 35).

In support of the close relationship I found to exist on account of the wood-anatomy, I cited (Mikrogr. 1, p. 374): (transl.) "Schumann (in Engler & Prantl, III, 6, p. 83) stated that the *Malvaceae* and the two following families (*Sterculiaceae* and *Tiliaceae*) had been united by French botanists; he had hardly any objection against this combination. It appears from my descriptions of the wood-anatomy occurring in the three families that it supports combination."

I finally note that tile cells are present only in the minority of the genera in each of the three families. This is confirmed by Miss M. M. Chattaway (New Phytologist 32, 1933, 261); see also Miss I. E. Webber (Trop. Woods 37, 1934, pp. 9—13).

In the genus *Grewia* (*Tiliac.*) tile cells are present only in part of the species (cf. Mikrogr. 1, p. 497, and Note 5).

**Note 17.** *Rubiaceae*, *Sonneratiaceae*, *Melastomaceae*, and *Connaraceae*.

The section of the Chief Key comprised by the Nrs 217 to 222, contains 11 kinds of wood, belonging to four families, viz. *Rubiaceae*, *Lythrarieae* (or *Sonneratiaceae*), *Melastomaceae*, and *Connaraceae*. Their wood is characterised by simple perforations occurring in all, or nearly all, division walls of the vessels (Nr 12, third par.), while libriform fibres, all or nearly all septate, form the ground mass of the wood (Nr 216, first par.) and are present in two kinds (Nr 217, first par.).

In the various taxonomic works very different opinions are expressed concerning their affinities; Durand's opinion comes closest to mine.

The wood-anatomy of the four families is so similar in many respects that I suggest that a close relationship exists among these species. On the other hand, this section of the Key is reached by only 10 numbers, which is too little stress on their actually great resemblance.

Of *Melastomaceae* I examined *Medinilla javensis*, *Astronia spectabilis*, *A. macrophylla*, *Melastoma molkenboerii*, *M. setigerum*, *M. asperum*, and *M. lanuginosum*; these are placed in Nr 222 (see also Note 3).

Now under Nrs 219 (second par.) and 220 (first par.) are found *Lythrarieae* and *Melastomaceae*. Durand assigned them as successive families to "Cohors" 12, the *Myrtales*, of the *Calyciflorae* (*Polypetalae*).

The *Connaraceae* appear in the Chief Key under Nr 220 (second par.) and the *Rubiaceae* are placed in Nr 218 (second par.). Durand accepts the *Connaraceae* as the 1st family of "Cohors" 11, the *Rosales*, of the *Calyciflorae* and the *Rubiaceae* to "Cohors" 1, the *Rubiales*, of the *Gamopetalae*. Here, the results obtained by the study of the wood-anatomy and the view of Durand are not in agreement. It is to be noted that the only species of *Rubiaceae*, placed in the Chief Key in this section, is *Guettarda speciosa*. This holds an isolated place (cf. Mikrogr. 4, p. 35, § 2). In addition, Benthams & Hooker classed the *Guettardeae* as a *Tribus* among the *Formae abnormales* and Valetons remarked (Bull. Dép. Agric. Ind. Néerl. 26, 1909, p. 7) that: (transl.) "*Guettarda* is generally a genus very much different from the other *Guettardeae* by the structure of its seed", and (l. c. p. 20): (transl.) "the *Guettardeae* form a very homogeneous group belonging neither to the *Coffeae* nor to the *Cinchoneae* according to our present concept of them."

#### Note 18. Ampelideae and Araliaceae.

The genus *Leea* (*Ampelid.*) is found in Nr 225 of the Chief Key. The species of *Leea* which I examined occur under 226 and 227; they are *L. sundaica*, *L. javanica*, *L. angulata*, and *L. sambucina*.

In Nr 225 (second par.), *Arthropphyllum diversifolium* (*Aral.*) is placed. I studied some other species of *Araliaceae* but these are found in other places of the Key.

The five species discussed at present have some peculiarities in their wood-anatomy in common. All, or nearly all, division walls of the vessels have simple perforations (Nr 12, third par.), all, or nearly all, libriform fibres, which form the ground mass of the wood, are septate (Nr 216, first par.) and they occur only in one single kind (Nr 217, second par.). The wood parenchyma is sparingly developed to absent (Nr 223, first par.), the vessels are with scalariform pits where in contact (Nr 224, first par.). Only these 5 species among all I investigated have this wood-structure in common.

On the other hand, the short way by which they are reached in the Chief Key (13 numbers) lays insufficient accent on their possibly close relationship.

In current taxonomic works, the *Ampelideae* and *Araliaceae* are not considered to be related. In my previous work, I made no suggestion towards a relationship either, but remarked (Mikrogr. 3, p. 645, § 2) (transl.) "Harms (in Engler & Prantl, III, 8, p. 22) stated that Seemann advocates the exclusion of *Arthropphyllum* from the *Araliaceae*, merely because the genus is characterized by a one-celled ovary whereas in all other characters it is typically *Araliaceae*. Harms believed that Seemann



attaches too much importance to the number of the members of the flower whorl."

The aberrant wood-anatomy of *Arthrophyllum* lends support to Seemann's view. There is also a remark of Hutchinson's worthy of note in this connection (cf. Notes on Affinity, p. 22) when he states when discussing the *Rhamnales*, to which the *Ampelideae* belong: "Closely allied to the *Celastrales*" and (l.c. p. 23), when discussing the Order of the *Umbelliferae*, to which the *Araliaceae* belong: "Probably partly derived from the *Calastrales* and *Rhamnales*."

**Note 19.** Sapindaceae, Burseraceae, Euphorbiaceae, Loganiaceae, and several other families.

The section of the Chief Key comprising the Nrs 228 to 284, is devoted to kinds of wood which are distinguished by the same characters as were mentioned in Note 18. There is, however, this difference, that the vessels, when in contact with each other do not show scalariform pits. This distinction is mentioned under Nr 224 (second par.).

The section is composed of 18 families, viz. *Geraniaceae*, *Myrsineae*, *Sapindaceae*, *Burseraceae*, *Oleaceae*, *Urticaceae*, *Euphorbiaceae*, *Bixineae*, *Samydaceae*, *Apocynaceae*, *Rubiaceae*, *Loganiaceae*, *Celastrineae*, *Anacardiaceae*, *Araliaceae*, *Compositae*, *Verbenaceae*, and the *Laurineae*. They are represented by 110 kinds of wood.

The section is reached by way of only 13 numbers which seems insufficient stress on possible relationships among some of these families.

The current taxonomic works, now and then, contain data indicating a relationship between two of the families mentioned here, rarely three of them are considered to be related.

Nr 233 contains the family of *Sapindaceae* (first par.), represented by a number of species and some genera. The second paragraph has *Canarium* (*Burser.*) represented by 6 species. This arrangement seems natural in the light of Hutchinson's classification, where *Sapindaceae* (family 198) are referred to the *Sapindales* (Order 57) and the *Burseraceae* (family 196) to the *Rutales* (Order 55) and the two Orders are taken with the *Meliales* (Order 56) as composing a group of related Orders. I have pointed out before (Mikrogr. 2, p. 325, foot-note) that *Ganophyllum falcatum*, which is at present referred to *Sapindaceae*, was put among *Burseraceae* by Bentham & Hooker and by Blume. Owing to the fruit, studied by Baillon and Radlkofer and to the anatomy, studied by Jadin, *Ganophyllum* is now regarded as Sapindaceous.

I support this latter view. On account of wood-anatomical characters I distinguished in the *Sapindaceae* six groups. *Ganophyllum falcatum* belongs to the second group, and the species of *Sapindaceae* considered here are all members of the sixth group. The groups were distinguished by me on the basis of the quantity and distribution of the wood parenchyma. Otherwise the *Sapindaceae* are very uniform in their wood-structure (cf. also Mikrogr. 2, p. 324, § 2).

Nr 245 (243) (first paragraph) has *Cleistanthus sumatranus* (*Euphorb.*) and the second paragraph has the *Bixineae*; the latter family is further

represented under 246 (244) and 247 (245) by a number of species and genera.

Nr 248 (246) (first par.) has several species of *Homalium* and *Casearia* (*Samyd.*); the second paragraph has many species and genera of *Euphorbiaceae*.

So three families are placed in two groups. The groups were set apart in Nr 244 (242) on account of a character that proved to be of small taxonomical value generally. It would seem that the three families are closely related, judging from their wood-anatomy.

Durand's classification holds nothing in favour of this conclusion. Engler-Gilg refer *Bixineae* and *Samydaceae* to the same "Reihe" and, similarly, Hutchinson refers them to the same Order; both authors keep the *Euphorbiaceae* in a non-related Order. Hutchinson (cf. Notes on Affinity, p. 19) thinks that the *Euphorbiaceae* are derived from several sources such as *Bixales*. To the latter Order belong the *Biraceae*, *Flacourtiaceae*, *Samydaceae*, etc.

In the *Euphorbiaceae* I have distinguished, on account of wood-anatomical characters, four groups (cf. Note 2 and Mikrogr. 5, p. 459, § 2 for their delimitation). The 28 kinds of Euphorbiaceous woods contained in the section now under discussion belong all to the first group.

In *Bixineae* I distinguished for similar reasons three groups. (Mikrogr. 1, p. 200, § 2). Group I is present here.

The *Samydaceous* woods I examined are all included here. On the whole, this arrangement fully agrees with the extensive foot-notes (l.c. 3, p. 611, § 2 and 5, p. 464, § 2). I point in particular to: (transl.) "The wood-structure of this group (I of the *Euphorbiaceae*) resembles very closely that of the *Bixineae*, *Violarieae* (*Alsodeia*) and *Samydaceae*." (cf. also Note 2 and the citations there).

Nr 265 (263) (first par.) contains *Geniostoma haemospermum*, *G. miquelianum*, and *G. oblongifolium* (Logan.) and *Siphonodon celastrineus* (*Celastr.*). The second paragraph of 265 (263) has *Orchipeda* (*Voacanga*) *grandifolia* and *Tabernaemontana sphaerocarpa* (*Apocyn.*); the third paragraph comprises *Psychotria robusta*, *P. aurantiaca*, and *P. viridiflora* var. *macrocarpa* (*Rubiaceae*). As these families have been placed into one number, though separated on account of a character of usually slight taxonomical value, I think that there is a closer relationship among them than was suspected so far.

Durand classed the *Apocynaceae* and the *Loganiaceae* among the *Gentiales* ("Cohors" 7) in the *Gamopetalae*, the *Rubiaceae* in "Cohors" 1 (*Rubiales*) in the *Gamopetalae* and the *Celastrineae* in "Cohors" 9 (*Celastrales*) in the *Polypetalae*.

Engler-Gilg placed *Apocynaceae* and *Loganiaceae* in the "Unterreihe", *Gentianineae* which form part of the *Contortae* ("Reihe" 5) of the *Sympetalae*, the *Rubiaceae* in the *Rubiales* ("Reihe" 8) of the *Sympetalae* and the *Celastraceae* in *Sapindales* ("Reihe" 24) of the *Choripetalae*. Hutchinson placed the *Apocynaceae* in Order 65 (*Apocynales*), the *Loganiaceae* in Order 64 (*Loganiales*), and the *Rubiaceae* in Order 66 (*Rubiales*). Order 64 and Order 65 belong to a group of more closely related Orders. He refers the *Celastrinae* to Order 51 (*Celastrales*). In the "Notes on

Affinity" (p. 24). Hutchinson remarked when discussing the *Loganiales*: "A very mixed group either mimicking or having direct affinity with several other families such as *Rubiaceae* (*Psychotria*), *Apocynaceae* etc.". In the same chapter (p. 25) he continued, when dealing with the *Apocynales*: "advanced fixed types from the preceding group (*Loganiales*)" and he said about the *Rubiales*: "A very natural group, but probably derived from more than one source, i.e. *Loganiales*". This, I believe, is rather in support of my conclusions.

In my "Mikrographie" I have not commented on possible relationships among these families but pointed to the special place occupied by several of the species discussed here (ll. cc. §§ 2). In particular *Tabernaemontana sphaerocarpa*, *Orchipedu grandifolia*, *Psychotria* spp., *Siphonodon celastrineus* deviate markedly from the rest of their families.

*Vernonia arborea* var. *javanica* (*Compos.*) occurs in Nr 272 (270) (also under Nr 354, with *Vernonia* in general; cf. Note 25). In the second paragraph of Nr 272 (270) are found *Garuga pinnata* and *Protium javanicum* (*Burser.*). I found no support for an opinion towards a close relationship in any of the taxonomic works, but I have previously noted (Mikrogr. 4, p. 256) that the wood-structure of *Vernonia arborea* var. *javanica* is very variable; this is in agreement with the morphological variation reported by Koorders and Valetón.

Nr 282 has *Geunsia farinosa* (*Verbenac.*) in the first paragraph. In the second are found *Litsea tomentosa*, *L. chinensis*, *L. chinensis* var. *littoralis* (*Laur.*). It is a long way through the Chief Key before these species are reached (24 numbers) which suggests also a close affinity. Not in my own, nor in the current taxonomic works is any indication to be found towards this relationship.

*Geunsia farinosa* appears to be separated from some *Verbenaceae* in Nr 273. These species, placed in Nrs 275 to 282, are *Gmelina villosa*, *Premna tomentosa*, *P. foetida*, *P. cyclophylla*, *P. leucostoma*, *P. rotundifolia*, and 5 species of *Vitex*. I have pointed out (Mikrogr. 4, p. 764, § 2) that *Geunsia farinosa* is intimately related in wood-structure to the rest of the *Verbenaceae*.

The wood-structure in *Litsea* is very similar in the various species (Mikrogr. 5, p. 103, § 2). The three *Litseas* in Nr 283 are placed there in complete isolation from the remainder of *Laurineae*, caused by the absence of oil and mucilage cells (cf. Note 14). The septate libriform fibres and the fibres of the wood parenchyma resemble each other more closely here than in most other cases (cf. Nr 283, first par.).

#### Note 20. *Lythrarieae* and *Verbenaceae*.

Nrs 285 and 286 have kinds of wood in which the wood parenchyma is abundant or very abundant (second par. of 223) and the inner-part of the growth layers is a wood parenchyma lamella, 4 to 7 cells thick (first par. of 284) while in this lamella the vessels are usually, or always, strikingly wider than elsewhere; the wood is thus ringporous.

Nr 285 has *Lagerstroemia speciosa* and *L. ovalifolia* (*Lythrac.*) (first par.), and in the second paragraph the *Verbenaceae*.



Nr 286 (first par.) contains *Tectona grandis* and the second paragraph has *Gmelina villosa*.

Only 13 numbers form the way through the Key leading to 285 and 286. This is but a weak accent on a possible relationship between *Lythrarieae* and *Verbenaceae*.

In the current taxonomic works I found no support for an opinion of this nature. I have stated previously (Mikrogr. 3, p. 575) that the four genera of *Lythrarieae* (*Crypteronia*, *Lagerstroemia*, *Duabanga*, and *Sonneratia*) are so different in their wood-anatomy that they should be preferably seen as belonging to four different families (cf. also Notes 25, 28, and 32). *Gmelina villosa* is among all *Verbenaceous* species I examined closest to *Tectona grandis* (l. c. 4, p. 764).

**Note 21.** Classification of *Avicennia* (Verben.).

When reviewing the Javan *Verbenaceae* as a whole, having discussed some parts of the family in advance (Notes 19 and 20), it appears that they are widely spread through the Chief Key.

Nr 9 has *Avicennia alba* and *A. officinalis*; *Tectona grandis* and *Gmelina villosa* (closely related, cf. Mikrogr. 4, 763, § 2) only occur under Nrs 285 and 286, and the remainder is found in the section 275 to 283 (cf. Note 19).

Both species of *Avicennia* are markedly distinct from the rest of the *Verbenaceae* by their wood-anatomy. Phloem strands are present in their wood (Nr 6, first par.) and only occurring in a peculiar parenchymatous layer (Nr 9, first par.). These characteristics are highly significant and ensure the species of *Avicennia* a position which is distinctly isolated.

The current taxonomical works offer small support for this conclusion.

I split the *Verbenaceae* into two groups (Mikrogr. 4, p. 763) and stated: (transl.) "In group II (*Avicennia alba* and *A. officinalis*) the wood consists of tangential layers of two kinds which alternate regularly. One layer has the common wood-structure but the other is very different, resembling secondary phloem. In group I the wood has no such tangential layers but shows the commonly found structure throughout. The wood of group I, and the structure of the "common" layers of group II are not greatly different and lend only slight support, I believe, to Van Tieghem's opinion that the species of *Avicennia* should be placed in a family different from the *Verbenaceae* (Journ. de Botanique 12, 1898, 356)."

At present, I have come to the view that "slight support" was too weak an expression, and I think that Van Tieghem was right. This is in accordance with the views of the monographer H. N. Moldenke, who considers *Avicennia* the representative of a monotypic family.

I further said (l. c. p. 764): "My findings agree with Bentham & Hooker's classification (Gen. Pl. II, 2, p. 112) and with Briquet (in Engler & Prantl, IV, 3a, p. 143). These authors separate *Avicennia* as a different division from that formed by the other genera."

**Note 22.** *Anacardiaceae*, *Sapindaceae*, *Araliaceae*, &c.

Twenty-three kinds of wood are contained in Nrs 300 to 309. Their

wood-anatomy is characterised by a ground mass consisting of libriform fibres, septate or non-septate and both rather numerous (second par. of 216) and the wood parenchyma is sparingly developed or absent (first par. of 300).

Six families are represented: *Anacardiaceae*, *Araliaceae*, *Tiliaceae*, *Sapindaceae*, *Pittosporaceae*, and *Laurineae*.

The way through the Chief Key leading to this section consists of 10 numbers (1b, 5b, 6b, 11b, 12c, 104b, 149b, 155b, 216b, 300). This is small evidence in support of a close relationship among the members of this section.

In the usual taxonomic works only *Anacardiaceae* and *Sapindaceae* are considered to be more or less related (both belonging to the *Sapindales*). Hutchinson thinks that *Araliaceae* are also somewhat related to these families. The latter belong to the Order *Umbelliferae* and this Order forms a related group with some others, among which the *Sapindales*. In this section of the Chief-Key *Araliaceae* occur twice; firstly under Nr 302 (*Trevesia sundaica*) and secondly under Nr 306 (*Aralia dasyphylla* var. *strigosa*), while *Buchanania florida* (*Anacardiaceae*) occurs in the first paragraph of 301 and *Schleichera trijuga* (*Sapindaceae*) in the first paragraph of Nr 305, each being connected with the numbers following.

Nr 307 has four species of *Pittosporum* (*Pittosp.*); the second paragraph has *Iteadaphne confusa* and *Lindera bibracteata* (*Laur.*). These latter occur also in Nr 308 and in the preceding Nrs 100 and 171.

I found nothing in support of a relationship between *Laurineae* and *Pittosporaceae*, as was suggested here by their wood-anatomy. Oil and mucilage cells are absent in *Lindera bibracteata* but present in the four other species of *Lindera* I examined (cf. also Notes 14 and 29).

### **Note 23.** *Sapindaceae*, *Leguminosae*, and *Urticaceae*.

The section of the Chief Key comprised between Nrs 309 to 320 contains 49 kinds of wood, belonging to three families: *Sapindaceae*, *Leguminosae*, and *Urticaceae*.

Their wood-anatomy is characterized by a ground mass of libriform fibres (septate or not, and both kinds rather numerous; second par. of 216) while the wood parenchyma is abundant (Nr 300, second par.).

The section is reached by way of 11 numbers which is inadequate to demonstrate the actually close resemblance of these woods.

The first paragraph of 309 has the *Sapindaceae* and the second paragraph refers to 313. The first paragraph of Nr 313 has *Albizzia tomentella* (*Legum.*) and the second the *Urticaceae*. *Albizzia tomentella* occurs also in Nr 623 (cf. Note 35). The position of these groups suggests a closer relationship between *Leguminosae* and *Sapindaceae* than was believed hitherto, a view supported by the position discussed in Note 1.

In the current taxonomic works I found no data in favour of my conclusion. In group III of *Urticaceae* (cf. Mikrogr. 6, p. 20) *Streblus asper* follows immediately the species of *Ficus*.

**Note 24.** Polygaleae, Anonaceae, Sapotaceae, Scrophularineae, and Euphorbiaceae.

The section in the Chief Key extending from 320 to 345 contains woods characterised by a ground mass of libriform fibres (all or nearly all non-septate; Nr 216, third par.) and in which metatracheal wood parenchymatous lamellae are always present. The lamellae are nearly always 1 cell thick, if 2 to 4 cells thick they are nearly always only locally present, connecting tangentially (at least for the greater part) at least c. 5, usually more medullary rays (Nr 320, first par.).

The section has 43 kinds of wood, belonging to 5 families: *Polygalaceae*, *Anonaceae*, *Sapotaceae*, *Scrophularineae*, and *Euphorbiaceae*.

Only 10 numbers lead to this section. This suggests little affinity. The usual taxonomic works offer little in support of a close relationship.

Engler-Gilg refer the *Polygalaceae* and *Euphorbiaceae* to "Reihe" 23 (*Geraniales*) but the first to "Unterreihe" 3 (*Polygalineae*) and the second to "Unterreihe" 5 (*Tricoccae*).

Hutchinson (Notes on Affinity, p. 23) discussing the Order of *Ebenales* (which contains the *Sapotaceae*) remarked: "Perhaps some affinity here with some *Anonaceae*".

I myself noted (Mikrogr. 5, p. 467, § 2): (transl.) "The wood-structure of this group II of *Euphorbiaceae* resembles those of *Ebenaceae*, *Sapotaceae*, and *Anonaceae*". It was also stated (l.c. 4, p. 421, § 2) (transl.) "Judging by their wood-structure the *Ebenaceae* are very closely related to the preceding family of *Sapotaceae*." All *Euphorbiaceae* placed in this section belong to "Group II" except *Cyclostemon longifolius* (cf. Notes 2 and 4).

**Note 25.** Urticaceae, Araliaceae, Lythrarieae, Rosaceae, &c.

The woods contained in the section of the Chief Key comprising the Nrs 352 to 364 are characterised by the following.

(Ground mass consisting of libriform fibres which are all, or nearly all, septate (Nr 216, third par.). Metatracheal wood parenchyma lamellae very often absent; if present more than one cell thick, if only one cell thick short to very short in a tangential direction and connecting usually not more than 2 or 3, at the utmost usually only locally a larger number of medullary rays (Nr 320, second par.). The medullary rays are firstly usually uni-seriate and usually consisting of upright cells and, secondly, of a wider type and nearly always partly consisting of compound rays. In the latter case the simple rays and the multiseriate stories of the compound rays about identical (Nr 345, first par.). No vertical schizolysigenous gum ducts, surrounded by wood parenchyma are present (Nr 346, second par.) and wood parenchyma is rare to very rare (Nr 351, first par.).

This wood-structure typifies 27 kinds of wood, belonging to 9 families, viz. *Urticaceae*, *Araliaceae*, *Laurineae*, *Compositae*, *Loganiaceae*, *Sterculiaceae*, *Tiliaceae*, *Lythrarieae*, and *Rosaceae*.



Only 14 numbers lead through the Key to this section and yet the resemblance of these woods to each other is remarkably close.

Some numbers in this section contain 2 or 3 families.

Nr 354 (first par.) contains *Polyscias nodosa* (Aral.). The second paragraph has *Litsea citrata* (Laur.) which occurs also in Nr 174. The third paragraph has the *Vernonia* spp. (Comp.) which I examined.

Nr 357 has *Melochia indica* (Stercul.); the second paragraph has several species of *Urticaceae*, which occur also in 358, 359, 360, and 361.

Nr 363 has *Crypteronia paniculata* and *C. paniculata* var. *leptostachya* (cf. Notes 20 and 28) in the first paragraph; the second has 9 kinds of *Pygeum* (Rosac.).

In the second paragraph of 362 reference is made to 363; the first paragraph has *Trichospermum javanicum* (Tiliac.). This arrangement again suggests relationships existing among the families determined here.

In the current taxonomical works some data are found in support of a closer relationship among these families than is usually believed to exist. They agree in referring *Sterculiaceae* and *Tiliaceae* to the same Order.

Durand (cf. Nr 363) placed *Lythrarieae* and *Rosaceae* into two consecutive "cohorts" (11 and 12) of the *Calyciflorae*. In "cohors" 15 (*Calyciflorae*) the *Araliaceae* are found (Nr 354). Engler-Gilg bring the *Araliaceae* and *Lythrarieae* to "Reihe" 30 of *Umbelliflorae* and "Reihe" 29 of *Myrtiflorae*.

In conclusion I wish to refer to the "Mikrographie" where I placed *Maoutia diversifolia* (vol. 6, p. 18, § 2) into Group I, § 2 of *Urticaceae*; this species occurs under Nr 352 in the Chief Key. The *Urticaceae* found in 358, 359, 360, and 361 form one intimately related section "α" in Group II.

I examined only two genera of *Compositae* (*Vernonia* and *Anaphalis*); their wood-anatomy is widely different (cf. l.c. vol. 4, p. 252, also footnote p. 256, Note 19; *Vernonia arborea* var. *javanica* was also comprised in Nr 272).

*Melochia indica* (Nr 357) is group II of *Sterculiaceae* and *Trichospermum javanicum* (cf. Nr 362) is section "e" in Group I of *Tiliaceae* (cf. l.c., vol. 1, pp. 418 and 481).

Among *Lythrarieae* the wood-anatomy is very variable (cf. l.c., vol. 3, p. 575, § 2; Notes 20 and 28, passim).

**Note 26.** Sapotaceae, Euphorbiaceae, Myrtaceae, Sterculiaceae, &c.

The section in the Chief Key represented by Nrs 365 to 385 contains 35 kinds of wood belonging to 9 families, viz. *Sapotaceae*, *Euphorbiaceae*, *Myrtaceae*, *Sterculiaceae*, *Scrophularineae*, *Tiliaceae*, *Olacineae*, *Rubiaceae*, and *Boraginaceae*.

These woods show generally the same characteristics as those discussed in the previous paragraph. In contrast, however, the wood parenchyma is abundant or very abundant (Nr 351, second par.). The metatracheal wood parenchyma lamellae only short in a tangential direction, on transverse section often interrupted or merging. In a radial direction as a rule one, more rarely 2 or 3 cells thick, often passing gradually

into the parenchyma among the libriform fibres (diffuse parenchyma) (Nr 364, first par.).

Nr 376 (first par.) has the *Sterculiaceae* represented by several species; the second paragraph contains *Wightia gigantea* (*Scrophul.*) (see also Note 24, and Nr 334).

Nr 375 (second par.) leads to 376; the first paragraph has *Barringtonia spicata*, *B. insignis*, and *B. gigantostachya* (*Myrtac.*); the latter occurs also in Nr 380.

Nr 383 (first par.) contains *Sterculia foetida* (*Stercul.*) and the second paragraph has *Ehretia javanica*, *E. dichotoma*, and *E. acuminata* (*Boragin.*). Between Nrs 375 and 383 *Schoutenia buurmanni* (*Tiliac.*) occurs in Nr 379, and in Nr 380 *Barringtonia gigantostachya* (*Myrtac.*). This suggests affinity among these families.

The current taxonomical works indicate some relation among these families, but opinions do not agree.

Unanimously, *Sterculiaceae* and *Tiliaceae* are referred to the same Order. Hutchinson placed *Euphorbiaceae* in the same group of related Orders.

Durand refers *Scrophularineae* and *Boragineae* to "cohortes" 9 and 8 of Series III in the *Bicarpellatae* (*Gamopetalae*).

Engler-Gilg arrange them in different "Unterreihen" in "Reihe" 6 of the *Tubiflorae*; Hutchinson refers the first to *Personales* (Order 75) and the second to *Boraginales* (Order 73) but these two Orders are not considered to be related. Nevertheless, Hutchinson suggests some affinity for the *Ebenaceae* and *Sapotaceae* with *Anonaceae* (Notes on Affinity, p. 23) and thinks that the *Euphorbiaceae* ("a composite family") may be "derived from several sources such as *Tiliales*, *Malvales* etc." (l. c. p. 19). The *Myrtales* (p. 17) are "probably epigenous representatives of the *Theales* and some *Tiliales*". The *Tiliales* (p. 18) are: "a fairly advanced group whence considerable evolution is evident, i. e. to *Celastrales*, *Rhamnales*, and the bulk of *Euphorbiaceae* (apetalous types)". The *Olacales* (p. 21) are: "more advanced types of the preceding group of the *Celastrales*" and "perhaps discoid types descended from the *Tiliales* and *Theales* etc."

On account of the wood-anatomy I suggested a very close relationship between *Ebenaceae* and *Sapotaceae* (Mikrogr. 4, p. 421, § 2). Group II in the *Euphorbiaceae* (all kinds found under 372 and 373) I found, as regards their wood-anatomy, much relation to *Ebenaceae*, *Sapotaceae*, and *Anonaceae* (l. c., vol. 5, p. 467).

Nrs 377 and 378 contain *Pterospermum javanicum*, *Pt. javanicum* var. *montanum*, and *Pt. diversifolium*, *Tarrietia sumatrana* and *Heritiera littoralis*, all belonging to Group II, which I distinguished in *Sterculiaceae*. *Sterculia foetida*, placed in Nr 383, belong to Group I of *Sterculiaceae*. *Schoutenia buurmanni* is found in Nr 379 and so succeeds immediately the species of Group II of *Sterculiaceae* (cf. also Note 6). I find no support in the current taxonomic work for a closer relationship among these or other groups arranged in this section of the Chief Key.

**Note 27.** Sterculiaceae, Guttiferae, Urticaceae, Myrtaceae, and Oleaceae.

The sections of the Chief Key from Nr 385 to Nr 414 comprises 106 kinds of wood, belonging to 5 families, viz. *Sterculiaceae*, *Guttiferae*, *Urticaceae*, *Myrtaceae*, and *Oleaceae*.

These woods are distinguished from those discussed in the previous Note by the metatracheal wood parenchyma lamellae which are distinctly longer, though varying in length, in a tangential direction, in transverse section much less often interrupted or merging, and considerably thicker radially; they do not change into diffuse parenchyma among the libriform fibres (Nr 364, second par.).

Only 15 numbers lead through the Key to this section which is inadequate stress on their close resemblance.

Twice occur three families in company. Nr 386 has *Firmiana colorata* (*Stercul.*) in the first paragraph; in the second occur *Garcinia celebica*, *G. balica*, *G. dulcia*, *G. salakensis* (*Guttif.*), *Streblus asper*, several spp. of *Ficus* and three spp. of *Celtis* (*Urtic.*), (cf. also Note 31 and 34).

Nr 401 has *Fraxinus eedenii* (*Oleac.*) in the first paragraph; in the second two *Garcinia* species occur (*Guttif.*), and numerous *Myrtaceae* spp. The first paragraph of Nr 400 refers to Nr 401 and the second contains the *Myrtaceae*. Many *Eugenia* spp. (*Myrt.*) are placed in 411, 412, and 413, in relation with many other *Eugenias* in the preceding numbers.

Relationship between two of the five families is now and then suggested in the usual taxonomical works, but the suggestions are of a different nature.

Durand placed *Sterculiaceae* and *Guttiferae* in resp. "cohors" 6 of the *Malvales* and "cohors" 5 of the *Guttiferales* (in Series I of the *Thalamiflorae*). The *Myrtaceae* are referred to "cohors" 12 of the *Myrtales* (Series III of the *Calyciflorae*, *Polypetalae*).

Engler-Gilg placed *Sterculiaceae*, *Guttiferae*, and *Myrtaceae* resp. in "Reihe" 26 (*Malvales*), "Reihe" 27 (*Parietales*), and "Reihe" 29 (*Myrtiflorae*). Hutchinson referred *Sterculiaceae* to *Tiliales* (Order 35), *Guttiferae* to *Guttiferales* (Order 34) and *Myrtaceae* to *Myrtales* (Order 33); Orders 33 and 34 belong to a group of related Orders.

Hutchinson stated concerning *Guttiferales* (Notes on Affinity, p. 18): "showing the same tendency as in the *Malvales*, i. e. stamens gathered into bundles" and the *Malvales* (Order 36) succeed the *Tiliales* in one group of more intimately related Orders. On *Myrtales* Hutchinson (l. c. p. 17) remarked: "probably epigenous representatives of the *Theales* and some *Tiliales* with leaves becoming opposite".

I examined only two genera of *Guttiferae* and found their wood-structure widely different (Mikrogr. 1, p. 254, § 2). In *Garcinia* I studied 6 species, all included in this section but not a single species of *Calophyllum* (the second genus of *Guttiferae* studied) is present (cf. also Note 31).

*Firmiana colorata* (*Stercul.*) is met with in Nr 386 (first paragraph) and somewhat related to *Guttiferae* but not to *Urticaceae*, judging by the data contained in the current taxonomical works. Nevertheless, the second paragraph of 386 has both the latter families. Nrs 387 to 397 have species



belonging to the two families and 397 and succeeding numbers contain 7 species of *Sterculia* (*Stercul.*).

The first paragraph of 401 has *Fraxinus cedonii* (*Oleac.*) and the second *Guttiferae* and *Myrtaceae*. I find no data sustaining a view towards a closer relationship in the usual taxonomical works.

**Note 28.** Euphorbiales, Ebenales, Malvales, and Sapindales, and their relationships.

The section in the Chief Key extending from 431 to 497 has 112 kinds of wood which have many characters in common and, moreover, are characterized by (cf. Nr 427, second par.) the following.

The medullary rays form a minor part of the wood, the second type of rays is less wide and less high, more rarely or never 2 or 3 of these wider medullary rays occur vertically above each other. In transverse sections the metatracheal wood parenchyma lamellae show either blind endings or are interrupted; they do not connect the wider medullary rays. The vessels do not border on the inner side of the metatracheal wood parenchyma lamellae and the vessel groups do not consist as a rule of 2—5 vessels adjacent in a tangential direction. The libriform fibres are shorter than 2300  $\mu$ .

Fifteen families are represented: *Apocynaceae*, *Urticaceae*, *Anacardiaceae*, *Euphorbiaceae*, *Sterculiaceae*, *Oleaceae*, *Myrtaceae*, *Tiliaceae*, *Datiiscacae*, *Laurineae*, *Ebenaceae*, *Lythrariceae*, *Rosaceae*, *Cornaceae*, and *Juglandaceae*.

The section as a whole may be subdivided but only for reasons of small taxonomical value. It is better discussed as a single unit.

Several families occur more than once e.g. *Apocynaceae* 4 times, *Anacardiaceae* twice, *Euphorbiaceae* 5, *Sterculiaceae* 3, *Oleaceae* 2, *Myrtaceae* 3, and *Tiliaceae* 2 times. This stresses the similarities in wood-structure existing among these families (cf. also Note 35), a resemblance which is inadequately indicated by the short way through the key leading to this section (16 numbers).

In the current taxonomical works some relationship between two (sometimes more) of the families are indicated but, again, opinions vary.

Durand arranged *Apocynaceae* and *Oleaceae* both into "cohors" 7 (*Gentianales*) in Series III of *Bicarpellatae* (*Gamopetalae*).

Engler-Gilg referred these two families to "Reihe" 5 of *Contortae* but to a different "Unterreihe". Hutchinson placed them successively in Order 65 (*Apocynales*) and 64 (*Loganiales*), these Orders belong to a larger group of related Orders.

Durand placed *Ebenaceae* into "cohors" 6 (*Ebenales*) of Series II (*Heteromerae*) in *Gamopetalae*; a weak link with both the previously mentioned families. Engler-Gilg put *Ebenaceae* into "Reihe" 4 (*Ebenales*) and Hutchinson into Order 61 (*Ebenales*) which belong to the same group as *Apocynales* and *Loganiales*.

Hutchinson remarked (Notes on Affinity, p. 25) concerning *Apocynaceae*: "Advanced fixed types from the preceding group and perhaps from *Sapotaceae*." Now the Order 61 (*Ebenales*) is composed of *Ebenaceae* and *Sapotaceae*.

Concerning *Oleaceae* Hutchinson said (l. c., p. 24), considering the Order 64 (*Loganiales*): "a very mixed group either mimicking or having direct affinity with several other families, such as *Rubiaceae*, *Melastomaceae*, *Apocynaceae*, etc."

*Sterculiaceae* and *Tiliaceae* belong both, according to Durand to "cohors" 6 (*Malvales*) of Series I (*Thalamiflorae*) of the *Polypetalae*. Engler-Gilg refer them to "Reihe" 26 (*Malvales*) but to different "unterreihen". Hutchinson placed them into Order 35 (*Tiliales*).

In his "Notes on Affinity" (p. 18) Hutchinson considered the *Tiliales* to be: "A fairly advanced group whence considerable evolution is evident, i. e. to *Celastrales*, *Rhamnales* and the bulk of *Euphorbiaceae* (apetalous types)."

*Euphorbiaceae* and *Tiliales* are placed in the same group of related Orders; they occur also repeatedly in the present section of the Chief Key.

Durand placed into Series VII (*Unisexuales*) of the *Monochlamydeae*, the *Euphorbiaceae*, *Urticaceae*, and *Juglandaeae*. The *Euphorbiaceae* are put by Engler-Gilg into the 23rd "Reihe" (*Geraniales*), the *Urticaceae* to the 12th "Reihe" (*Urticales*) and the *Juglandaeae* into the 8th "Reihe" (*Juglandales*). Hutchinson referred the three families resp. to Order 38 (*Euphorbiales*), Order 50 (*Urticales*), and Order 58 (*Juglandales*). The degree of relationship is, it will be admitted, valued very differently.

Hutchinson stated on *Euphorbiales* (l. c., p. 19), represented only by the *Euphorbiaceae*: "a composite family probably derived from several sources such as *Bixales*, *Tiliales*, *Malvales*, *Celastrales*, and perhaps *Sapindales*." A perusal through the section of the Chief Key now under discussion, will show that the arrangement of families agrees fairly well with Hutchinson's views.

The *Anacardiaceae* are kept apart by Durand from the families occurring in this section of the Key. Engler-Gilg refer them to "Reihe" 24 (*Sapindales*); Hutchinson to Order 57 (*Sapindales*). Order 57 is placed with Order 58 (*Juglandales*) and Order 59 (*Umbelliflorae*) which includes the *Cornaceae*, into one group of related Orders. Hutchinson (l. c., p. 22) further thinks: "*Sapindaceae* and *Anacardiaceae* especially related to some *Euphorbiaceae*, from some of which part of the latter may have arisen."

In the light of what has been said so far, it seems that the amount of relationship among *Anacardiaceae*, *Juglandaeae*, and *Euphorbiaceae* is judged very differently. In this section of the Chief Key the two first families do not occur close together.

Durand placed the *Myrtaceae* and *Lythrarieae* into "cohors" 12 (*Myrtales*) of Series III in the *Calyciflorae* (*Polypetalae*). The following families occur in the section of the Chief Key belonging to Series III: *Rosaceae* (*Rosales* or "cohors" 11), *Datisceae* (*Passiflorales* or "cohors" 13), *Cornaceae* (*Umbellales* or "cohors" 15). Durand thus brings these five families to the same Series and believes them to be more or less related. Engler-Gilg placed *Myrtaceae* and *Lythrarieae* into the same "Unterreihe" (*Myrtineae*) of "Reihe" 29 (*Myrtiflorae*), *Rosaceae* into "Reihe" 21 (*Rosales*), *Datisceae* into "Reihe" 27 (*Parietales*), and *Cornaceae* into "Reihe" 30 (*Umbelliflorae*).

Hutchinson referred *Myrtaceae* to Order 33 (*Myrtales*), *Lythrarieae* to

Order 21 (*Lythrales*), *Rosaceae* to Order 40 (*Rosales*), *Datisceae* to Order 30 (*Cucurbitales*), and *Cornaceae* to Order 59 (*Umbelliflorae*). Again, relationships are judged very differently. Engler-Gilg brought *Tiliaceae* and *Sterculiaceae* to *Malvales* ("Reihe" 26) and to the next "Reihe" (27, *Parietales*) the *Datisceae*. Now, *Datisceae* and *Tiliaceae* occur both under Nr 451 (see also below).

Hutchinson (p. 17) said about the *Myrtales*: "probably epigenous representatives of the *Theales* and some *Tiliales* with leaves becoming opposite."

In the now discussed section of the Chief Key, *Myrtaceae* are found e. g. under Nrs 470 and 478. Between those numbers, *Lythrarieae* are inserted in 473 and *Rosaceae* in 476; *Cornaceae* occur in 481, 485, 486, and 487. *Datisceae* were placed in Nr 451, and several *Myrtaceae* in 446, 447, 448, and 449.

The current taxonomical works have no indications towards a closer relationship between *Laurineae* and the remaining 14 families occurring in this section. *Cryptocarya densiflora* is the only representative; its wood has neither oil nor mucilage cells (cf. Note 19).

In the "Mikrographie" four species of *Alstonia* are described; three resemble each other closely (*A. scholaris*, *A. angustiloba*, and *A. spatulata*) and the fourth (*A. villosa*) is rather different (cf. l. c., vol. 4, p. 573, § 2). *Alstonia villosa* is placed in 480 whereas the three other *Alstonias* are placed in 488, 489, and 490. The position is well supported in Engler & Prantl IV, 2 (1895) by K. Schumann and also by Bentham & Hooker (vol. 2, p. 705).

*Bouea macrophylla* (*Anacardiaceae*) belongs to group I distinguished by me in *Anacardiaceae* (l. c. vol. 2, p. 447, § 2), and *Semecarpus* to the second group. In the Key this is reflected by their position in Nrs 436 and 445.

The woods of group II of *Euphorbiaceae* (l. c., vol. 5, p. 467) resemble those of *Ebenaceae*, *Sapotaceae*, and the whole of *Anonaceae*. The family of *Ebenaceae* is found in the present section of the Key close to the representatives of group II (*Euphorb.*; l. c., vol. 5, p. 459).

Two widely different groups compose the family of *Oleaceae* (l. c., vol. 4, p. 518). 'All members of the first group are placed into this section; *Ligustrum glomeratum* represents the second group and is found in a widely different place.

The first sub-group "a" of group II in *Myrtaceae* (l. c., vol. 3, p. 393) is entirely contained in Nrs 447, 448, and 449. Of the sub-group "b" (cf. 412) is present *Eugenia densepunctata* (in 448) which is to be explained from its position nearest to "a" in sub-group "b" (l. c., p. 393).

Sub-group "c" of group I in *Tiliaceae* (l. c., vol. 1, p. 482, § 2) is composed of *Grewia celtidifolia*, *G. excelsa*, and *G. eriocarpa* and sub-group "d", composed of *G. laevigata* and *G. laevigata* var. *oblongifolia*, is found in 450 and 451 (cf. also Notes 5 and 6).

The position of the two genera of *Ebenaceae* is to be understood from my earlier work (l. c., vol. 4, p. 421).

*Lythrarieae* occur only in 473 within the section, i. e. *Crypteronia paniculata* and its variety *leptostachya*; they are also found in 363. The



genera of this family are very different (cf. l. c., vol. 3, p. 575, and Note 25).

Of *Cornaceae*, for similar reasons, species of *Marlea* only are found in 485, 486, and 487. *Marlea javanica*, however, was inserted as early as Nr 56 (cf. Note 13, and l. c., vol. 3, p. 705, § 2).

In the section now under discussion, some numbers contain two families; this close proximity, again, may point to a closer relationship than was thought to exist.

Nr 436 has (first par.) a species of *Anacardiaceae* and (second par.) a species of *Euphorbiaceae*. The characters mentioned in the preceding 20 numbers leading to Nr 436 are shared by these two species. Regarding the accepted relationship between *Anacardiaceae* and *Euphorbiaceae*, I refer to what was said in Notes 2, 4, and 19. The first paragraph of 435 refers to 436 and the second has several *Urticaceae*. This suggests links between the latter family to both the previously mentioned but there is no support in the current taxonomical works.

Nr 445 has two species of *Semecarpus* (*Anacardiaceae*) in the first paragraph; in the second *Fraxinus eedenii* (*Oleaceae*).

Nr 446 (first par.) contains *Chionanthus macrocarpa* (*Oleaceae*) and (second par.) many *Eugenia* spp. (*Myrtaceae*). Considering the position as present in Nrs 436, 445, and 446 it seems that the wood-anatomy suggests a much closer relationship among *Anacardiaceae*, *Euphorbiaceae*, *Oleaceae* and *Myrtaceae* than was hitherto suspected.

Nr 451 (first par.) has *Tiliaceae*, represented by *Grewia laevigata* and its variety *oblongifolia*; the second paragraph contains *Datisceae* (*Tetrameles nudiflora*). The long way by which they are reached in the Key points to a great similarity in their wood-anatomy.

Durand and Hutchinson do not suggest any relationship between these two families. Engler-Gilg refer them to 2 successive "Reihen". Referring to what has been said earlier in this Note, I quote (Engler & Prantl, 1st ed., III, 6a): (transl.) "the affinities of *Datisceae* have often been discussed but no agreement was reached."

Nr 454 has *Sterculiaceae*, i. e. *Pterospermum javanicum*, its variety *montanum*, and *Pt. diversifolium* (first par.); the second paragraph has several species of different genera in *Euphorbiaceae*. Durand and Engler-Gilg do not suggest any closer relationship but Hutchinson thinks they are related (cf. above and Hutchinson l. c., p. 18, 19).

No support is found, apart from what has been cited previously, towards a conception of closer relationship in the following cases of families in juxtaposition: Nr 473 (*Lythrarieae* and *Euphorbiaceae*), Nr 475 (*Apocynaceae* and *Tiliaceae*; cf. also Note 6), Nr 478 (*Sterculiaceae* and *Myrtaceae*; cf. also Hutchinson, l. c. p. 17), Nr 481 (*Euphorbiaceae* and *Cornaceae*) and the complex Nrs 491 and 488 (*Juglandaceae*, *Oleaceae*, and *Apocynaceae*; cf. also Hutchinson l. c. p. 24 and 25).

**Note 29.** Myrsineae, Moringeae, Malvaceae, Capparidaceae, Boraginaceae, and Leguminosae.

The section of the Chief Key extending from Nr 499 to Nr 515, contains 23 kinds of wood. In addition to the characters mentioned in the

numbers leading to this section (13 in total) they have the following characteristics in common. All or nearly all medullary ray cells are procumbent; the cells of the upper and lower radial row (c. q. rows) usually only rarely upright or more or less resembling upright cells (Nr 497, second par.). The wood parenchyma without crystals, or not immediately adjacent to vessels, is composed of substitute parenchyma fibres and of wood parenchyma strands which have always, or nearly always, only one partition wall (Nr 498, first par.). Five families are represented in this section, viz. *Myrsineae*, *Moringae*, *Malvaceae*, *Capparidaceae*, *Boragineae*, and *Leguminosae* (*Papilionaceae*).

The comparatively short way by which the section is reached, is insufficient accent on their similarity while the peculiar characteristics of the wood parenchyma suggest rather strongly that a definite relationship may exist among them.

Nr 505 has in the first paragraph all *Papilionaceae* examined by me, and in the second paragraph *Cordia suaveolens* (*Boragineae*).

In the first paragraph of Nr 504 reference is made to Nr 505, and in the second paragraph *Crataeva nurvala* (*Capp.*) is met with. This arrangement of the three families suggests relationship.

Durand referred *Malvaceae* and *Capparidaceae* resp. to "cohors" 6 (*Malvales*) and "cohors" 2 (*Parietales*), both part of Series I (*Thalamiflorae*) in *Polypetalae*. The *Myrsineae* and *Boragineae* are resp. placed into "cohors" 5 (*Primulales*) and "cohors" 8 (*Polemoniales*) both belonging to *Gamopetalae* in the *Polypetalae*.

Engler-Gilg referred *Moringae* and *Capparidaceae* both to "Reihe" 19 (*Rhoeadales*) and resp. to "Unterreihe" 4 (*Moringineae*) and "Unterreihe" 2 (*Capparidaceae*). To some degree, this corresponds with the placing of *Leguminosae* into "Reihe" 21, the *Rosales*.

Hutchinson arranged *Moringae* and *Capparidaceae* as successive families (37 and 36) in Order 10 (*Capparidales*).

The *Leguminosae* examined by me (Mikrogr. 3) were separated into 3 groups (l. c., p. 24, § 2) and the first group, *Papilionaceae*, is found in this section of the Key. This is supported by Hutchinson's remark (Notes on Affinity, p. 19) when he stated that the *Papilionaceae* are a very natural family.

Similarly, I divided *Malvaceae* also into 3 groups (Mikrogr. 1, p. 378, § 2). The first group is distinctly different from the remaining two, which explains that only this first group is contained in the section of the Key under discussion now.

*Aegiceras corniculatum* occupies an isolated place in *Myrsineae* (l. c., vol. 4, p. 298, § 2). It is the only representative of the family in this section.

For similar reasons, *Cordia suaveolens* (cf. l. c., vol. 4, p. 689) is in the present section the only representative of *Boragineae*.

I note finally that all kinds of wood in the section, except *Crataeva nurvala*, have the storied wood structure.

**Note 30.** *Meliaceae*, *Combretaceae*, and *Rutaceae*.

The woods contained in the section extending from 517 to 547 in the

Chief Key are characterized by the following: wood parenchyma without crystals or not immediately adjacent to vessels, consisting of substitute parenchyma fibres and wood parenchyma strands, or only of wood parenchyma strands, all or for the greater part with more than 3 partition walls (Nr 516, first par.). The characters typifying section 499—515, are also present here. The present section falls apart into three smaller groups (cf. Nr 517). The first extends 518 to 523 and is distinguishable on account of the wood parenchyma being rare to very rare. This first part has 13 kinds of wood belonging to *Meliaceae*, *Combretaceae*, and *Rutaceae*.

Being placed higher in the Key the resemblance to each other of these woods is still greater than among the woods discussed in the previous Note.

Nr 519 contains *Lumnitzera* (*Combret.*) as the genus; the species are placed in Nr 520 and their wood-anatomy is very similar. The three kinds recur in Nrs 549 and 550 (cf. Note 33). In 519 (second par.) *Rutaceae*, as a family, are found; seven kinds occur in 521, 522, and 523 and closely resemble each other (cf. Mikrogr. 2, p. 19, 20, § 2). The arrangement of these woods in the Nrs 522 and 523 is entirely in keeping with my previous results. These 7 Rutaceous woods recur in 556 and 557, while *Muraya exotica* var. *sumatrana* is also met with in Nr 539 (cf. Notes 32 and 33).

Nr 518 has in its second paragraph a reference to 519 and in its first *Meliaceae*, as a family represented by three kinds of *Cedrela*. The arrangement in these numbers suggests a close relationship among the three families; most closely related are, I believe, *Combretaceae* and *Rutaceae*. Some information concerning a relationship between *Meliaceae* and *Rutaceae* may be derived from Notes 31 and 33. The relationship between *Meliaceae* and *Combretaceae* was also suggested in Note 1 and as affinity was suspected there for other reasons, the evidence offered in this present Note supports my earlier statements.

The usual taxonomical works have some data which support my conclusions to some extent.

Durand referred *Meliaceae* and *Rutaceae* to "cohors" 7 (*Geraniales*) of Series II (*Disciflorae*) in the *Polypetalae*. Engler-Gilg placed them into the "Unterreihe" *Geraniineae* in the *Geraniales*. Hutchinson arranged them in Order 56 (*Meliales*) and Order 55 (*Rutales*) and refers these Orders to a group of related ones. *Combretaceae* are, however, kept quite apart by all authors.

In the "Mikrographie" I distinguished four groups in *Meliaceae* (l. c., vol. 2, p. 116, § 2); the second group comprises *Cedrela* and is rather isolated. This explains why only *Cedrela* occurs in this section and no other *Meliaceae*.

**Note 31.** *Rutaceae*, *Guttiferae*, *Hypericineae*, *Meliaceae*, and *Urticaceae*.

The second sub-section of the three indicated in the preceding Note comprises Nrs 524 to 531. It is distinguished by abundant or very abundant wood parenchyma, especially the metatracheal parenchyma (cf. Nr 517, second par.).

Twenty two kinds of wood were referred to it, belonging to *Rutaceae*,



*Guttiferae*, *Hypericineae*, *Meliaceae*, and *Urticaceae*. The similarity of these kinds of wood is generally the same as that found in the first subsection, the places in the Key being the same.

Nr 524 (first par.) has 5 *Evodia* spp. (*Rutac.*), closely allied as regards their wood anatomy. *Rutaceae* are also found in 520, 521, 522, and 523.

Nr 527 (first par.) has *Cratoxylon* (*Hyper.*) as a genus; the species are placed in 528 and resemble each other closely (cf. also Mikrogr. 1, p. 242, § 2). Under Nr 527 *Walsura pinnata* is met with (*Meliac.*). The second paragraph of 526 has a reference to 527 while in the first paragraph of 526 are found 5 spp. of *Calophyllum* (*Guttif.*). The *Calophyllums* are very similar (cf. also Notes 32, 34, and 35).

The arrangement of the three families discussed so far, suggests a close relationship, closest perhaps between *Hypericineae* and *Meliaceae*.

Nr 531 (first par.) has *Gironniera cuspidata* (*Urtic.*) and *Garcinia celebica* (*Guttif.*) in the second paragraph. Nr 530 (first par.) refers to 531, and the second paragraph of 530 has four out of six *Garcinia* species examined by me.

In Nr 529 (first par.) Guttiferous *Garcinia dioica* occurs and the second paragraph refers to 530. Nr 529 has been split into two paragraphs on account of a character of slight taxonomical value. All *Garcinias* recur in the Key (cf. Note 34).

The position of *Gironniera cuspidata* and the 6 *Garcinia* spp. suggests a possible relationship between *Urticaceae* and *Guttiferae*. It seems to be, however, a somewhat isolated point of contact, as *Gironniera cuspidata* is aberrant in its wood-anatomy from *Urticaceae* as a whole (cf. l. c., vol. 6, p. 21, 22, § 2). It is to be noted, on the other hand, that in Nr 386 are combined four spp. of *Garcinia* and several *Urticaceae* (cf. Note 27).

The genera *Calophyllum* and *Garcinia*, both belonging to *Guttiferae*, differ in their wood-anatomy wider than is usually found in the genera of a single family (cf. l. c., vol. 1, p. 254, § 2). For this reason they were placed under different, quite separate, numbers in this section of the Key.

Some data in support of an affinity among the families now being considered may be derived from the current taxonomical works.

Durand placed *Hypericineae* and *Guttiferae* as consecutive families into "cohors" 5 (*Guttiferales*) of Series I (*Thalamiflorae*) in *Polypetalae*. Hutchinson accepted them as families 123 and 126 resp. in Order 34 (*Guttiferales*). Engler-Gilg referred to sub-family *Hypericoideae* (in the family *Guttiferae*), *Cratoxylon*, *Calophyllum* and *Garcinia*.

Durand arranged *Rutaceae* and *Meliaceae* into "cohors" 7 (*Geraniales*) of Series II (*Disciflorae*) of *Polypetalae*; Engler-Gilg placed them into the same "Unterreihe" (*Geraniineae*) of "Reihe" 23 (*Geraniales*). Hutchinson considered *Rutaceae* to belong to Order 55 (*Rutales*) and *Meliaceae* to Order 56 (*Meliales*) and the Orders to a group of related Orders. All authors keep *Urticaceae* quite apart.

I refer further to Notes 30, and 32 and wish to attract attention to the fact that the relationships suggested in this present Note are again stressed, in Notes 30 and 32, on different counts which strengthens my conclusions.

**Note 32.** Rutales, Meliales, Sapindales, Guttiferales, and Tiliales.

The third of the three sub-sections distinguished in Note 30, is comprised by Nrs 532 to 547. This third sub-section is distinguished by the presence of neither rare nor abundant wood parenchyma (Nr 517, third par.).

Twenty-five kinds of wood are represented, belonging to *Euphorbiaceae*, *Guttiferae*, *Cupuliferae*, *Lythrarieae*, *Rutaceae*, *Sapindaceae*, *Meliaceae*, *Simarubaceae*, and *Tiliaceae*.

It may be deduced from the position of this sub-section in the Key that the similarity among these woods is approximately the same as existing in the preceding two sub-sections.

Among these 9 families, three occur more than once.

*Euphorbiaceae* (*Homalanthus populneus* and *H. giganteus*) are found in Nr 533 (second par.) and in Nr 534 (first and second par.), *Excoecaria virgata* is met with in Nr 536 (first par.) and *Gelonium glomeratum* in Nr 540 (first par.).

I found (Mikrogr. 5, p. 460 and 467, § 2) that both the species of *Homalanthus* and *Excoecaria* resemble each other very closely whereas *Gelonium glomeratum* is a transition between *Homalanthus* and the rest of the second group in *Euphorbiaceae*, which I distinguished on account of wood-anatomical characters (cf. l. c.; and also Note 35). The kinds of wood occurring between 533 and 540 (Euphorb.) closely resemble the species just mentioned and each other.

Of *Rutaceae* occurs *Murraya exotica* var. *sumatrana* in Nr 539 (second par.); the same variety is found under Nrs 523 (cf. Note 30) and 557 (Note 33). *Aegle marmelos*, *Micromelum pubescens*, and *M. pubescens* var. *denticulata* were referred to 545 and 547, the first recurring in 605, and *Aegle* and both the *Micromelums* in 604 (cf. Note 35).

This arrangement is in accordance with my findings (l. c., vol. 2, p. 19, § 2).

*Meliaceae* are represented in Nr 541 (first par.) by *Melia azedarach*, *M. azedarach* var. *javanica*, *M. bogoriensis*, and *M. composita*. They recur in 597 and resemble each other closely. The same applies to *Sandoricum indicum* and *S. nervosum* (occurring in 544, first paragraph, and recurring in 611; cf. also Note 35).

It is to be noted, however, that the woods of *Melia* and *Sandoricum* are so widely different (cf. l. c., vol. 2, p. 116, § 2) that on account of their wood-anatomy they suggest to be separate families.

*Duabanga moluccana* (*Lythrar.*) was placed into Nr 536 (second par.) side by side with *Excoecaria* (see above and Note 20). When discussing *Lythrarieae* I stated (l. c., vol. 3, p. 575, § 2): (transl.) "The 4 genera examined cannot be divided into groups according to their wood-structures; the differences among them are too wide. At best it would seem possible to bring *Lagerstroemia* and *Duabanga* to one group." It was further said (l. c., p. 576): (transl.) "It appears that the differences among *Sonneratia*, *Lagerstroemia*, and *Duabanga* are so wide that they seem to belong to different families."

The first paragraph of Nr 535 refers to 536; the second paragraph

contains 5 *Calophyllum* species (*Guttif.*), all I examined, and the third paragraph has the genus *Castanea* (*Cupulif.*). I examined 3 species of *Castanea*, all closely alike, and found under 537 and 538. The five *Calophyllums* were already referred to 526 (cf. Note 31) and recur twice again (cf. Notes 34 and 35). This arrangement supports the views towards a closer relationship among these four families suggested in previous Notes on different grounds.

Nr 540 (first par.) has *Euphorbiaceae* (*Gelonium glomeratum*) and the second paragraph has *Sapindaceae* (*Harpullia imbricata* and *H. cupanioides*). Both species recur in 590 (cf. Note 35), they are closely alike and the latter is mentioned in the foot-note to 532.

Nr 539 (first par.) refers to 540 and the second paragraph contains *Murraya exotica* var. *sumatrana* (*Rutac.*) which was also placed into 523 (cf. Note 30) and recurs in 557 (Note 33). It is again apparent that the arrangement of these three families is in accordance with affinities suggested in previous Notes.

Nr 545 contains *Berria ammonilla*, *B. quinquelocularis* and *Pentace polyantha* (*Tiliac.*), which are also found in Nr 546. In the second paragraph of 545 occur *Aegle marmelos*, *Micromelum pubescens*, and *M. pubescens* var. *denticulata* also occurring in 547. All this is in accordance with my earlier results (i. e., vol. 2, p. 19, § 2). *Pentace polyantha* recurs in 602 (cf. Note 35). *Aegle marmelos* recurs in 605 (cf. Note 35). Both *Micromelums* are found again in 604 (cf. Note 35). In Nr 544 (second paragraph) occurs a reference to 545, and in the first paragraph are found two species of *Sandoricum* (*Meliac.*), all I examined and closely alike. They occur both in 611 (cf. Note 35).

Earlier in this Note, it was pointed out why the species of *Melia* are absent in 541.

Some data on the affinities existing among the nine families discussed in this present Note, are found in the current taxonomic works. They are of a various character.

Durand placed *Rutaceae*, *Meliaceae*, and *Simarubeae* into "cohors" 7 (*Geraniales*) of Series II (*Disciflorae*) in *Polypetalae*, and the *Tiliaceae* into "cohors" 6 (*Malvales*) of Series I (*Thalamiflorae*) in *Polypetalae* while he referred to "cohors" 5 (*Guttiferales*) the *Guttiferae*, in the same series I. *Sapindaceae* he arranged in "cohors" 10, *Sapindales* of the Series II (*Disciflorae*), and *Lythrarieae* to "cohors" 12 (*Myrtales*) in Series III (*Calyciflorae*) in *Polypetalae*. The *Euphorbiaceae* and *Cupuliferae* went into Series VII of the *Uniscruales* of the *Monochlamydeae*; the *Euphorbiaceae* forming the first and *Cupuliferae* the final family of the Series.

Engler-Gilg assigned *Rutaceae*, *Meliaceae* and *Simarubeae* to the first "Unterreihe" (*Geraniineae*) of "Reihe" 23 (*Geraniales*). *Euphorbiaceae* were placed into "Unterreihe" 5 (*Tricoccae*) of "Reihe" 23. *Sapindaceae* were brought to "Reihe" 24 (*Sapindales*), *Tiliaceae* to "Reihe" 26 (*Malvales*), *Guttiferae* to "Reihe" 27 (*Parietales*), *Lythrarieae* to "Reihe" 29 (*Myrtiflorae*), and the *Fagaceae* to "Reihe" 11 (*Fagales*).

Hutchinson referred *Rutaceae* (family 194) and *Simarubaceae* (family 195) to the *Rutales* (Order 55), *Meliaceae* to Order 56 (*Meliales*),



and *Sapindaceae* (family 198) to Order 57 (*Sapindales*). *Guttiferac* (family 126) belong to Order 34 (*Guttiferales*) and *Tiliaceae* to *Tiliales* (family 128, Order 35). Both the latter Orders belong to another group of related Orders.

His views on the affinity of *Tiliales* and *Euphorbiaceae* were cited before (cf. Notes 2, 16, and 19).

*Lythraceae* are referred by Hutchinson as family 72 to Order 21 (*Lythrales*), *Fagaceae* (family 163) to Order 48 (*Fagales*). Concerning *Sapindales* Hutchinson stated (Notes on Affinity, p. 22): "*Sapindaceae* and *Anacardiaceae* especially related to some *Euphorbiaceae*, from some of which part of the latter may have arisen."

Finally I wish to stress that *Rutaceae* and *Meliaceae* represented in this section of the Key, seem to be related (cf. Notes 30 and 31). The present Note contains some good examples of a repeated occurrence in company of some families which stresses very effectively any opinion of a closer relationship than was suspected for the usual taxonomical reasons.

**Note 33.** *Combretaceae*, *Gesneraceae*, *Capparidaceae*, *Aceraceae*, and *Rutaceae*.

The section of the Key from 548 to 623 contains woods distinguished by the same characters as found in the section 499 to 515. It is different, however, in having the wood parenchyma (when without crystals or not adjacent to vessels) composed of strands only or together with substitute parenchyma fibres; the strands have all, or in majority, at the utmost 2 or 3 partition walls (Nr 516, second par.). This section is subdivided into 3 smaller sub-sections; the first extends from 549 to 557 and is distinguished by the presence of rare or very rare wood parenchyma.

Fourteen kinds of wood are represented in this first sub-section, belonging to *Combretaceae*, *Gesneraceae*, *Capparidaceae*, *Aceraceae*, and *Rutaceae*.

The similarities in wood-structure are, as may be derived from the position of the sub-section in the Key, of the same nature as discussed in Notes 30—32; the characters mentioned in Nrs 516 (second par.) and 548 (first par.) point in particular to an affinity as was discussed in Note 30.

Nr 552 (first par.) has *Cyrtandra cuneata* (*Gesneraceae*) and in the second paragraph two species of *Capparis* (I examined three), belonging to *Capparidaceae*.

These species of *Capparis* (*C. micracantha* and *C. subacuta*) are closely alike as regards their wood-anatomy and occur in Nr 553. The first paragraph of 551 refers to 552 and in the second paragraph of 551 is a reference to 554. Now Nr 554 (first par.) has *Acer niveum* (*Aceraceae*) and in the second paragraph *Rutaceae*. Nrs 556 and 557 have seven kinds of Rutaceous woods (*Lunasia costulata*, *Zanthoxylum budrunga*, *Z. budrunga* var. *paucijuga*, *Z. budrunga* f. *puberula*, *Murraya exotica* var. *sumatrana*, *Glycosmis simplicifolia*, and *G. pentaphylla*).

These seven Rutaceous kinds were already found in Nrs 522 and 523

in the Key, and *Murraya exotica* var. *sumatrana* is also met with in 539 (cf. also Notes 30 and 32). The coupling of the seven species is in accordance with my earlier findings (Mikrogr. 2, p. 18, § 2).

Nr 549 (second par.) refers to 551 and in the first paragraph occurs the genus *Lumnitzera* (Combret.). Nr 550 has the three kinds I examined (*L. coccinea*, *L. racemosa*, and *L. racemosa* var. *pubescens*); they resemble each other closely.

The three *Lumnitzeras* were also placed into Nr 520 a position which laid still greater stress on a relationship between Combretaceae and Rutaceae than is the case here (cf. Note 30).

So far, the relationships between Gesneraceae and Capparidaceae, and between Aceraceae and Rutaceae seem very close.

On consulting the current taxonomical works it appeared that Durand referred Gesneraceae to "cohors" 9 (Personales) in Series III (Bicarpellatae) in Gamopetalae, and Capparidaceae to "cohors" 2 (Parietales) of Series I (Thalamiflorae) of Polypetalae. Aceraceae were placed into "cohors" 10 (Sapindales) and Rutaceae into "cohors" 7 (Geraniales); both "cohortes" belong to Series II (Disciflorae) in Polypetalae. Combretaceae are arranged by Durand in "cohors" 12 (Myrtales) of Series III (Calyciflorae) in Polypetalae. Durand, therefore, suspects the Aceraceae and Rutaceae to be most nearly related among these five families.

Engler-Gilg referred Aceraceae and Rutaceae to successive "Reihen", resp. 24 (Sapindales) and 23 (Geraniales). The other families are kept further apart.

Hutchinson thinks that Aceraceae and Rutaceae are most closely related and assigns them to Orders 57 (Sapindales) and 55 (Rutales); both Orders form part of a group of related Orders.

In my previous work (l. c., vol. 2, p. 407) when discussing the only species of Aceraceae I examined (*Acer nigrum*) I stated: (transl.) "The wood is very closely resembling that of Sapindaceae but there are some differences."

**Note 34.** Rhamnales, Leguminosae, Guttiferales, and Bignoniaceae.

The second sub-section (cf. Note 33) extends from 558 to 579. It is distinguished because the wood parenchyma is abundant (or very abundant) in particular the metatracheal parenchyma (Nr 548, second par.).

The sub-section contains 35 kinds of wood. The following families are represented: Guttiferae, Anacardiaceae, Loganiaceae, Sapindaceae, Leguminosae, Rhamnaceae, Capparidaceae, Urticaceae, Malvaceae, Rutaceae, and Bignoniaceae.

The position in the Chief Key, occupied by this sub-section is nearly identical to the sections discussed in the four preceding Notes and the affinities of its woods are therefore of a similar nature, best comparable, perhaps, to Note 31.

Anacardiaceae, represented by *Gluta renghas*, occur in Nr 561 (first par.) and Loganiaceae, represented by *Fagraea morindaefolia*, *F. obovata*, and *F. javana* are found in the second paragraph. These woods closely resemble each other. The similarity between *Gluta renghas* and *Aphania montana* are discussed in Note 35.

Nr 563 has *Sapindaceae* (*Aphania montana*) and, in the second paragraph, *Leguminosae* (*Bauhinia malabarica* and *Crudia bantamensis*, also found in Nr 564). These woods are very similar and here a link seems to exist between *Sapindaceae* and *Leguminosae* (cf. Note 1).

Nr 565 (first par.) has again *Leguminosae* (*Adenanthera microsperma* and *A. pavonina*). In the second paragraph of the same number, *Ziziphus jujuba* (*Rhamnaceae*) is met with. *Ziziphus jujuba* occurs also under Nr 586 and there in company of quite different groups (cf. Note 35). The wood-anatomy as found in *Aphania montana*, *Ziziphus jujuba* and several species of *Leguminosae* suggests that certain affinities exist among *Leguminosae*, *Rhamnaceae*, and *Sapindaceae*.

Nr 568 (first par.) contains *Gymnartocarpus venenosa* (*Urtic.*). *Malvaceae* occur in the second paragraph, represented by *Eriodendron anfractuosum*, *Bombax malabaricum*, and *Bombax* sp. (aff. *B. insignis* ?). They form the second group distinguished by me in *Malvaceae* (Mikrogr. 1, p. 378, § 2).

Nr 574 (first par.) has *Bignoniaceae*, represented by *Oroxylum indicum* (cf. also Note 35, as it occurs again in 597 and 612). In the second paragraph is found *Garcinia* (*Guttif.*) as a genus. The six species I examined are keyed out in 575 and 576 (cf. also Notes 27 and 31).

Nr 573 (first par.) refers to 574, and the second paragraph of 573 contains a reference to the familie of *Leguminosae* as it leads to 577, 578, and 579 where *Dialium indum*, *Cynometra ramiflora*, *Acrocarpus fraxinifolius*, *Acacia leucophloea*, and *A. tomentosa* are found.

The arrangement of these *Bignoniaceae*, *Leguminosae* and *Guttiferae* (Nrs 573 and 574) leads to the acceptance of a close affinity among them. It has been pointed out that a close relationship might be assumed among *Sapindaceae*, *Leguminosae*, and *Rhamnaceae* and so, as a whole, the arrangement of the five families in this sub-section of the Chief Key, suggests a near relationship.

It will be observed that a group of *Guttiferae* (five species of *Calophyllum*) holds a somewhat isolated position from the other *Guttiferae*, as it is placed in Nr 559. These *Calophyllums* occur also under Nrs 526, 535, and 582 (cf. Notes 31, 32, and 35). An explanation for the distance between *Garcinia* and *Calophyllum* is found in "Mikrographie" (vol. 1, p. 254, § 2) where the wood-anatomy of *Garcinia* and *Calophyllum* was found to be more different from each other than was usual between two genera belonging to the same family (cf. also Note 31).

The usual taxonomic works present some data in support of the affinities I suggested, though of a various character.

Durand placed *Anacardiaceae* and *Sapindaceae* into "cohors" 10 (*Sapindales*) of Series II (*Disciflorae*) in the *Polypetalae*.

Engler-Gilg arranged them in "Reihe" 24 (*Sapindales*) and Hutchinson in Order 57 (*Sapindales*). This, then, fully supports the outcome of my study into the wood-anatomy of *Sapindaceae* and *Anacardiaceae*.

Durand placed *Rhamnaceae* and *Leguminosae* at some distance from the preceding families. The *Rhamnaceae* he referred to "cohors" 9 (*Celas-trales*) and the *Leguminosae* to "cohors" 11 (*Rosales*) of the Series III (*Calyciflorae*) of *Polypetalae*.



Engler-Gilg referred *Rhamnaceae* to "Reihe" 25 (*Rhamnales*) and the *Leguminosae* to "Reihe" 21 (*Rosales*).

Hutchinson placed the *Rhamneae* into Order 54 (*Rhamnales*) and *Leguminosae* represented Order 41. Concerning *Guttiferales* Hutchinson stated ('Notes on Affinity', p. 18): "showing the same tendency as in the *Malvales*, i. e. stamens gathered into bundles."

**Note 35.** Combretaceae and Leguminosae. Relationships of Euphorbiaceae, Tiliales, Rutales, Sapindales, &c.

Nrs 580 to 623 comprise the third sub-section of the section 548—623 (cf. Notes 33 and 34). It is distinguished by the presence of neither rare nor abundant wood-parenchyma (Nr 548, third par.).

Seventy six woods represent in this sub-section thirteen families, viz. *Sapindaceae*, *Guttiferae*, *Anacardiaceae*, *Rhamneae*, *Simarubaceae*, *Thymelaeaceae*, *Euphorbiaceae*, *Bignoniaceae*, *Combretaceae*, *Leguminosae*, *Meliaceae*, *Tiliaceae*, and *Rutaceae*. The degree of similarity is of the same order as in both the preceding Notes.

In this sub-section, seven of the thirteen families occur more than once; three families recur four times. This frequency is larger than was generally the case and it is due to the fact that the woods comprised in this sub-section are often similar to a very high degree. This implies that they are distinguished by characters which have, very often, only a slight taxonomical value.

Nr 580 (first par.) has *Dodonaea viscosa* (*Sapind.*) and Nr 590 first par.) contains *Harpullia imbricata* and *H. cupanoides*, also of *Sapindaceae*. Both the latter species were also found in Nr 540 (cf. Note 32) and *H. cupanoides* occurred also in Nr 532.

*Anacardiaceae* occur in 583 or are placed between the Nrs 580 and 590, which stresses again the relationship between *Anacardiaceae* and *Sapindaceae* (cf. Note 34).

*Melanochyla tomentosa* var. *glabrescens* (*Anac.*) is found in Nr 584 (first par.) and five species of *Mangifera* (*Anac.*) in the second paragraph of Nr 584; this is in accordance with my earlier findings (Mikrogr. 2, p. 447, § 2). In the previous Note, it was demonstrated that *Sapindaceae* and *Anacardiaceae* appeared to be related, and this on account of the similarity in the woods of quite different species. The outcome of the present Note, therefore, supports strongly what has been found before.

In Nr 582, i. e. between Nrs 580 (*Sapindaceae*) and 583 (*Anacard.*), five *Calophyllums* are met with (*Guttif.*). These five species of *Calophyllum* were also placed into Nrs 526, 535, and 559 (cf. Notes 31, 32, and 34). Their position indicates the relations existing among *Guttiferae* (*Calophyllum*), *Anacardiaceae* and *Sapindaceae*.

The affinity between *Gluta reinghas* (*Anacard.*) and *Aphania montana* (*Sapind.*) has been discussed before (Note 34). Now the first paragraph of 560 refers to 561 (first paragraph: *Gluta reinghas*). The second paragraph of 560 refers to 563 which has *Aphania montana* (first paragraph). So, for different reasons, affinity between *Anacardiaceae* and *Sapindaceae*

is suggested by their wood-anatomy, and further relationship to *Guttiferae* (*Calophyllum*) appears when Nr 559 is taken into account.

Nr 592 (first par.) has *Terminalia teysmannii* (Combret.), which was also placed under 229 (cf. Note 1). Nr 593 (first par.) again has *Combretaceae*, represented by *Terminalia bellerica* var. *laurinoides* and *T. bialata*. These *Terminalias* are distinguished by a larger or smaller number of vessels pro mm<sup>2</sup> in transverse section, which is generally a character of small value (cf. Nr 593).

*Combretaceae* occur again in Nr 613 (first par.), represented by *Terminalia javanica* and *T. catappa*, and in 614 (first par.) by *T. bellerica* var. *laurinoides* and *T. bialata* (cf. 593). Nrs 613 and 614 are different through the presence or absence of very large clusters of crystals in the wood parenchyma cells, another character of slight value.

Both *Leguminosae* and *Combretaceae* occur in 4 places of this subsection. In three out of four times, *Leguminosae* were placed in the second paragraph of a number, whereas the *Combretaceae* occurred in the first paragraph (cf. Nrs 592, 593, and 614). A close resemblance in the wood-anatomy of these families appears to be present (cf. also Note 1).

Nr 592 (second par.) has *Cassia timorensis* (also found under 296; cf. Note 1). The second paragraph of 593 has *Albizzia montana*, *Cassia javanica*, *C. fistula*, *C. siamea*, and seven species of *Pithecellobium*, including *P. moniliferum*. *Cassia javanica* recurs in 296 (cf. Note 1), and in 621. *C. fistula* and *C. siamea* also occur in 296 (cf. Note 1). *Pithecellobium moniliferum* was placed into 299 (cf. Note 1). Nrs 594 and 595 contain the several species. The arrangement is here not in accordance with my views on the taxonomical relationships as explained previously (Mikrogr. 3, p. 24, § 2).

*Leguminosae* are also found under Nr 601 (*Dichrostachys cinerea*) and in the second paragraph of 614, where a reference is made to the numerous species keyed out in Nrs 615 to 623. Again, this is in contradiction with my previously expressed views (l. c.).

Durand, among the taxonomists referred to in this paper, is the only author who supported to some extent a relationship between *Leguminosae* and *Combretaceae*.

In the second paragraph of Nrs 590, 597, and 601, and in the first paragraph of 612, *Bignoniaceae* are met with. In 590 occurs *Dolichandrone rheedii*, in 597 *Oroxylum indicum* (cf. also Nr 574 and Note 34; and Nr 612). In 601 occur *Stereospermum hypostictum* and *St. glandulosum*. When considering the various places of *Oroxylum indicum*, it appears that it is found in close proximity to *Leguminosae* (Nr 574), to *Meliaceae* (with the 4 species of *Melia* in 597), to *Thymelaeaceae* with *Phaleria capitata* (Nr 612) and to *Meliaceae*, also in Nr 612 with 2 *Sandoricum* species.

Now *Thymelaeaceae* occur in the second paragraph of 587, the first of 599, and the second of 611 (resp. *Gonystylus miquelianus*, *Wikstroemia junghuhniana*, and *Phaleria capitata*).

The wood-anatomy found in the *Bignoniaceae* and the *Thymelaeaceae*, discussed in this Note, is very similar in the various genera and species and suggests affinity. This is in accordance with my previous conclusions

(cf. l. c. vol. 4, p. 728, § 2, and vol. 5, p. 420). The arrangement of *Leguminosae*, *Meliaceae*, *Combretaceae*, *Tiliaceae*, *Rutaceae*, and *Simarubaceae* suggests further affinities existing among these families and *Bignoniaceae* and *Thymelaeaceae*.

Nrs 587 and 608 have, in the first paragraphs, *Picrasma javanica* (*Simarub.*). Nr 609 (first par.) has the genus *Ailanthus*. Nr 610 contains the species of *Ailanthus* (*Ai. moluccana* var. *javanica*, *Ai. malabarica* var. *mollis* and *Ai. malabarica*) which is in accordance with my views expressed previously (l. c. vol. 2, p. 76, § 2). I pointed out there, also, that the differences in wood-anatomy of *Picrasma* and *Ailanthus* were very small. Actually, the species keyed out between 587 and 610 resemble each other closely.

In Nr 597 are found four kinds of *Melia*, viz. *M. azedarach*, *M. azedarach* var. *javanica*, *M. bogoriensis*, and *M. composita*; they are closely alike. In Nr 611 are found the two species of *Sandoricum* I examined, *S. indicum* and *S. nervosum*, also resembling each other closely. The four *Melias* were also placed into 541 (first par.), and both the *Sandoricums* into 544 (cf. Note 32).

Nr 587 (first par.) has *Picrasma* (*Simarub.*); in the second paragraph is found *Gonystylus miquelianus* (*Thymel.*). In the first paragraph of 586 is a reference to 587, and in the second paragraph is found *Ziziphus jujuba*, the sole representative of *Rhamnaceae* I examined (cf. also 565 and Note 34). It has been advised by several taxonomists that *Gonystylus* should not be assigned to *Thymelaeaceae* or, at least, be seen as an aberrant genus. In its wood-anatomy, however, it is closely related to both the other genera of *Thymelaeaceae* which I examined (cf. l. c. vol. 5, p. 420, § 2).

*Ziziphus jujuba* is also found under 565 (cf. Note 34). This earlier place in the Key is surrounded by quite different families (esp. *Leguminosae*) than are found near 586.

Earlier in this Note, the position of *Harpullia* in Nrs 590, 540, and 532 was indicated. A reference was also made to *Dolichandrone rheedii* as found in 590. The second paragraph of 589 leads to 590, and the first paragraph of 589 contains *Excoecaria agallocha* (*Euphorbiac.*). This arrangement points to a closer relationship among *Sapindaceae*, *Bignoniaceae*, and *Euphorbiaceae*. The affinities of *Euphorbiaceae* are further stressed by their position in 540 where they occur side by side again with *Sapindaceae*, this time represented by *Gelonium glomerulatum* and *Excoecaria agallocha*. Both the latter species have proved to be very nearly related (cf. l. c. 5, pp. 460 and 467, § 2, and also Note 32).

In this Note I have pointed out that *Leguminosae* occurred in Nrs 592, 593, 594, and 595. Now *Combretaceae* occur in Nr 592 (*Terminalia teysmannii*; cf. also 299 and Note 1) and in Nr 593 (*T. bellerica* var. *laurinoides*, and *T. bialata*; cf. also 614). In the first paragraph of 591 a reference is made to 592 and in the second paragraph of 591 to 593. The differentiation in 591 rests on a character of small taxonomical value. Generally speaking, the position of the *Combretaceae* and *Leguminosae* in this sub-section fully supports the affinity which I suggested in Note 1.

I have also indicated, earlier in this Note, the several numbers in which *Meliaceae*, *Bignoniaceae*, and *Guttiferae* are found (574, 597, and



612). To these families are linked the *Leguminosae*, which becomes clear when it is realized that the first paragraph of 573 leads to 574, and the second paragraph of 573 has part of *Leguminosae*. These *Leguminosae* are keyed out in 577, 578, and 579. This means that the wood-anatomy as present in these four families suggests affinity among them and so it appears that *Meliaceae* and *Leguminosae* are related, this time for entirely different reasons than were presented in Note 1. I pointed out before, in addition, that in Nr 601 the families of *Leguminosae* and *Bignoniaceae* were combined. This is new stress on the affinity existing between the two families.

Nr 602 (first par.) has *Tiliaceae* (*Pentace polyantha*; cf. also 546 and Note 32). The second paragraph of 602 has *Rutaceae*, viz. *Micromelum pubescens*, *M. pubescens* var. *denticulatum* (both occurring in 547, cf. Note 32), *Citrus hystrix*, *Aegle marmelos* (also found in 547), and *Feronia lucida*. It will be noticed that *Pentace polyantha* and various *Rutaceae* (*Micromelum* and *Aegle*) occur in immediate vicinity in Nrs 545, 546 and 547 and also in 602, 603, 604, and 605. The conclusion is justified that the woods of these species are closely resembling each other and that a relationship between *Tiliaceae* and *Rutaceae* exists.

The first paragraph of 600 refers to 601 where *Leguminosae* and *Bignoniaceae* are found. The second paragraph of 600 refers to 602, or, to *Tiliaceae* and *Rutaceae*.

The second paragraph of 599 is a reference to 600, and the first paragraph of 599 has *Wikstroemia junghuhniana* of *Thymelaeaceae*. These 5 families appear to be closely linked.

Nr 544 (second par.) refers to 545 where *Tiliaceae* and *Rutaceae* are met with. The first paragraph of 544 has *Meliaceae* (*Sandoricum indicum* and *S. nervosum*). The three families suggest in this manner to be related (cf. Note 32). Moreover, the 5 families just discussed seem to be related to *Meliaceae* also.

The *Sandoricums* recur in 611 (first par.). On considering the position of *Thymelaeaceae* and *Simarubeae* as found in 609, 610, and 611 (cf. also earlier in this Note) it appears that relationships exist among *Simarubeae*, *Thymelaeaceae*, and *Meliaceae*.

The striking resemblance between *Leguminosae* and *Combretaceae* is still further stressed in the final part of this sub-section. of the Key.

In 614 (first par.) occurs *Terminalia bellerica* var. *laurinoides* (*Combretac.*), and *T. bialata* (also found in 593, cf. above in this Note). In 593 these *Terminalias* are in proximity of nearly the same species as in 614. In the second paragraph of 614 *Leguminosae* are referred to as a family. The species are keyed out from 615 to 623. *Cassia javanica*, found in 621, also occurs in Nr 296 (cf. Note 1) and in 595 (cf. above). *Albizia lebeekoides* and *A. lebbek* are found in 623 (also in 292, cf. Note 1), *A. tomentella* in 623 (also in 313, in proximity of other families, cf. Note 23).

*Combretaceae* and *Leguminosae* are distinguished here on account of characters of small taxonomical value and the woods resemble each other closely. The position, as it is found in this part of the Key, is new evidence for their affinity.

The second paragraph of 612 refers to 613, and the first paragraph contains *Bignoniaceae*, represented by *Oroxylum indicum* (cf. Nrs 574 and 597, Note 34 and what has been said earlier in the present Note). Here the position is comparable to my earlier findings and again stress is laid on the affinities existing among the families now discussed.

Data of a varying character, partly in support of the affinities among these thirteen families, may be derived from the current taxonomical works.

Durand, as we have seen, admitted a close relationship between *Anacardiaceae* and *Sapindaceae* ("cohors" 10). This is agreed to by Engler-Gilg ("Reihe" 24, though to different "Unterreihe") and Hutchinson (Order 57). At a short distance of *Sapindaceae* and *Anacardiaceae*, appear *Rhamnaceae* ("cohors" 9, *Celastrales*, of the *Disciflorae*) and the *Leguminosae* ("cohors" 11, *Rosales*, of Series III (*Calyciflorae*) of the *Polypetalae*).

Engler-Gilg refer *Rhamnaceae* to "Reihe" 25 but *Simarubaceae*, *Euphorbiaceae*, *Meliaceae*, and *Rutaceae* all to "Reihe" 23 (*Geraniales*) and even to the same "Unterreihe" (*Geraniineae*) with the exception of *Euphorbiaceae* which belong to a different "Unterreihe".

Hutchinson placed *Simarubaceae* and *Rutaceae* into Order 55 (*Rutales*), *Meliaceae* into Order 56 (*Meliales*), and *Sapindaceae* and *Anacardiaceae* to Order 57 (*Sapindales*). These three Orders are combined into a group of related Orders. The *Rhamnaceae*, however, belonging to Order 54 (*Rhamnales*) are not included in this group of related Orders.

Durand assigned *Simarubaceae*, *Meliaceae*, and *Rutaceae* to "cohors" 7 (*Geraniales*) of Series II in *Disciflorae* of the *Polypetalae*.

Engler-Gilg refer these families to the same "Unterreihe" (*Geraniineae*) of "Reihe" 23. Hutchinson placed them into Orders 55 and 56.

Durand placed *Tiliaceae* into "cohors" 6 (*Malvales*) in Series I (*Thalamiflorae*) of the *Polypetalae*, which is not far from the preceding three families. Engler-Gilg referred *Euphorbiaceae* also to "Reihe" 23, though to "Unterreihe" 5 (*Tricoccae*), which seems still closer. Hutchinson's views have been indicated above.

Among the remaining families, *Leguminosae* and *Combretaceae* are considered to be most related by Durand, as was referred to before. The other taxonomical works offer different opinions. Engler-Gilg bring *Combretaceae* to "Reihe" 29 (*Myrtiflorae*) and *Leguminosae* to "Reihe" 21 (*Rosales*). Hutchinson referred them resp. to Orders 33 (*Myrtales*) and 41 (*Leguminosae*).

Of Hutchinson's "Notes on Affinity" I cite (p. 22): "*Sapindaceae* and *Anacardiaceae* especially related to some *Euphorbiaceae* from some of which part of the latter may have arisen." On *Tiliales*, Hutchinson commented (l.c., p. 18): "A fairly advanced group whence considerable evolution is evident, i.e. to *Celastrales*, *Rhamnales* (petaliferous, disciform types) and the bulk of *Euphorbiaceae* (apetalous types)". On *Euphorbiales* (l.c., p. 19) Hutchinson stated: "A composite family probably derived from several sources such as *Bixales*, *Tiliales*, *Malvales*, *Celastrales*, and perhaps *Sapindales*." (cf. also Note 2). On *Myrtales*, Hutchinson (l.c., p. 17) remarked: "Probably epigenous representatives of the *Theales* and some *Tiliales* with leaves becoming opposite." The *Leguminosae*, Hutchinson

believed to be (l. e., p. 19): "Prolific and highly successful group derived from the *Rosales* through the *Mimosaceae* and *Caesalpiniaceae* and ending in the very natural family of *Papilionaceae*."

## Index.

- Acacia** *leucophloea* 451  
     *tomentosa* 451  
**Aceraceae** 449, 450  
**Acer** *niveum* 449, 450  
**Acrocarpus** *fraxinifolius* 451  
**Actinidiaceae** 423  
**Actinodaphne** *macrophylla* var. *angustifolia* 427  
**Actinophora** *buurmanni* 420  
     *fragrans* 420  
**Adenanthera** *microsperma* 451  
     *pavonina* 451  
**Aegiceras** *corniculatum* 444  
**Aegle** *marmelos* 447, 448, 455  
**Ailanthus** *malabarica* 454  
     *malabarica* var. *mollis* 454  
     *moluccana* var. *javanica* 454  
**Albizzia** 413  
     *lebbek* 412, 455  
     *lebekkoides* 412, 455  
     *montana* 413, 453  
     *tomentella* 413, 435, 456  
**Alsodeia** 416, 432  
     *cymulosa* 427  
**Alstonia** *angustiloba* 442  
     *scholaris* 442  
     *spathulata* 442  
     *villosa* 442  
**Altingia** 414, 424, 425  
     *excelsa* 424, 425  
     *excelsa* var. *velutina* 424, 425  
**Ampelideae** 430, 431  
**Anacardiaceae** 434, 435, 440, 441, 442, 443, 449, 450, 451, 452, 456  
**Anaphalis** 437  
**Anonaceae** 416, 431, 436, 438, 442  
**Aphania** *montana* 413, 450, 451, 452  
**Apocynaceae** 428, 431, 432, 433, 440, 441, 443  
**Apocynales** 428, 432, 433, 440  
**Aporosa** *arborea* 415  
     *campanulata* 415  
     *frutescens* 415  
     *microcalyx* 415  
**Araliaceae** 426, 427, 430, 431, 434, 435, 436, 437  
**Aralia** *dasyphylla* var. *strigosa* 435  
**Arthrophyllum** 430, 431  
     *diversifolium* 430  
**Astronia** 417, 418  
     *macrophylla* 417, 430  
     *spectabilis* 417, 430  
**Avicennia** 434  
     *alba* 434  
     *officialis* 434  
**Baccaurea** *javanica* 415  
     *racemosa* 415  
**Barringtonia** *gigantostachya* 438  
     *insignis* 438  
     *spicata* 438  
**Bauhinia** *malabarica* 413, 451  
**Bennettia** *horsfieldii* 415  
**Bergsmia** *sumatrana* 426  
**Berria** *ammonilla* 448  
     *quinquelocularis* 448  
**Bicarpellatae** 438, 448, 450  
**Bignoniaceae** 450, 451, 452, 453, 454, 455, 456  
**Bixales** 415, 423, 432, 441, 456, 457  
**Bixineae** 415, 416, 426, 427, 431, 432  
**Bombax** *malabaricum* 451  
     sp. (aff. *B. insignis*?) 451  
**Boraginales** 438  
**Boraginaceae** 437, 438, 443, 444  
**Bouea** *macrophylla* 442  
**Bruguiera** 426  
**Bruinsmia** *styracoides* 422  
**Buchanania** *florida* 435  
**Burseraceae** 431, 433  
**Caesalpiniaceae** 457  
**Calophyllum** 439, 446, 448, 451, 452, 453  
**Calyciflorae** 410, 411, 414, 421, 430, 437, 439, 441, 448, 450, 451, 456  
**Camellia** *lanceolata* 425  
**Canarium** 431  
**Capparidaceae** 443, 444, 450  
**Capparidales** 444  
**Capparis** 449  
     *micracantha* 449  
     *subacuta* 449  
**Caprifoliaceae** 414, 421, 422, 423, 424, 425  
**Caryospermum** *serrulatum* 426  
**Casearia** 416, 432  
     *coriacea* 415  
     *flavovirens* 415  
     *grewiaefolia* 415  
     *tomentosa* 415  
**Cassia** *fistula* 413, 453  
     *javanica* 413, 453, 455



- siamea 413, 453  
 timorensis 413, 453  
 Castanea 448  
 Casuarina 427  
 Casuarinaceae 427, 428  
 Casuarinales 427  
 Cedrela 445  
   febrifuga var. glabrior 412  
   febrifuga var. velutina 412  
 Celastrales 431, 432, 438, 441, 451, 456  
 Celastrineae 421, 424, 426, 428, 431, 432  
 Celtis 439  
 Chionanthus macrocarpa 443  
 Choripetalae 432  
 Cinchoneae 430  
 Citrus hystrix 455  
 Claoxylon indicum 415, 416, 418  
   indicum var. gracilius 416, 418  
 Cleistanthus sumatranus 415, 431  
 Coffeae 430  
 Columbia javanica 420  
 Combretaceae 410, 411, 412, 413, 444,  
   445, 449, 450, 452, 453, 454, 455, 456  
 Compositae 431, 433, 436, 437  
 Connaraceae 429, 430  
 Contortae 432, 440  
 Cordia suaveolens 444  
 Cornaceae 421, 424, 426, 440, 441, 442,  
   443  
 Crataeva nurvala 444  
 Cratoxylon 446  
 Crudia bantamensis 413, 451  
 Crypteronia 434  
   paniculata 437  
   paniculata var. leptostachya 437, 442  
 Cryptocarya densiflora 427, 442  
 Cucurbitales 442  
 Cupuliferae 447, 448  
 Cyclostemon 419  
   longifolius 415, 416, 418, 436  
   minahassae 415, 416, 419  
   ramiflora 451  
   subcubicus 415, 419  
 Cyrtandra cuneata 449  
 Daphniphyllaceae 414  
 Daphniphyllum 425  
   glaucescens 414, 421, 422  
   glaucescens var. blumeianum 414,  
   421, 422  
 Datisceae 440, 441, 442, 443  
 Dialium indum 451  
 Dichrostachys cinerea 453  
 Dilleniaceae 421, 423  
 Dilleniales 423  
 Disciflorae 445, 446, 448, 450, 451, 456  
 Distylium 414, 424  
   stellare 424, 425  
 Dodonaea viscosa 452  
 Dolichandrone rheedii 453, 454  
 Duabanga 434, 447  
   moluccana 447  
 Ebenaceae 416, 423, 436, 438, 440, 442  
 Ebenales 436, 440  
 Ehretia acuminata 438  
   dichotoma 438  
   javanica 438  
 Elaeodendron 424  
   glaucum 421  
   glaucum var. macrocarpum 421  
 Ericaceae 421  
 Eriodendron anfractuosum 451  
 Eucylostemon 419  
 Eugenia 439, 443  
   densepunctata 442  
 Euphorbiaceae 410, 414, 415, 416, 417,  
   418, 421, 422, 425, 426, 427, 431,  
   432, 436, 437, 438, 440, 441, 442,  
   443, 447, 448, 449, 452, 454, 456  
 Euphorbiales 440, 441, 456  
 Eurya 414, 424, 425  
 Evodia 446  
 Excoecaria 447  
   agallocha 454  
   virgata 447  
 Fagaceae 448, 449  
 Fagales 448, 449  
 Fagraea javana 450  
   morindaefolia 450  
   obovata 450  
 Feronia lucida 455  
 Ficus 435, 439  
 Firmiana colorata 439  
 Flacourtia catafracta 415  
   ramontchi 415  
   rukam 415  
 Flacourtiaceae 432  
 Fraxinus eedenii 439, 440, 443  
 Gamopetalae 414, 423, 424, 430, 432,  
   438, 440, 441, 450  
 Ganohyllum falcatum 431  
 Garcinia 439, 446, 451  
   balica 439  
   celebica 439, 446  
   dioica 446  
   dulcis 439  
   salakensis 439  
 Garuga pinnata 433  
 Gelonium glomeratum 447, 448, 454  
 Geniostoma haemospermum 432  
   miquelianum 432  
   oblongifolium 432  
 Gentiales 432, 440  
 Gentianeae 432  
 Geraniaceae 431  
 Geraniales 436, 441, 445, 446, 448, 450,  
   456  
 Geraniineae 445, 446, 448, 456

- Gesneraceae 449, 450  
 Geunsia farinosa 433  
 Gironniera cuspidata 446  
 Gluta renghas 450, 452  
 Glycosmis pentaphylla 449  
     simplicifolia 449  
 Gmelina villosa 433, 434  
 Gonystylus miquelianus 453, 454  
 Gordonia excelsa var. macrocarpa 425  
 Grewia 419, 420, 421, 429  
     celtidifolia 419, 420, 442  
     eriocarpa 419, 420, 442  
     excelsa 419, 420, 442  
     laevigata 419, 420, 442, 443  
     laevigata var. oblongifolia 419, 420, 442, 443  
     microcos 419, 420  
 Guettarda 430  
     speciosa 430  
 Guttiferae 439, 440, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454  
 Guttiferales 439, 446, 447, 448, 449, 450, 452  
 Gymnartocarpus venenosa 451  
  
 Haemocharis integerrima 425  
 Hamamelidaceae 414, 421, 422, 424, 425  
 Harpullia cupanoides 448, 452, 454  
     imbricata 448, 452, 454  
 Heptapleurum 428  
 Heritiera littoralis 438  
 Heteromerae 440  
 Homalanthus 447  
     giganteus 447  
     populneus 447  
 Homalium 416, 418, 432  
     javanicum 415  
     tomentosum 415  
 Horsfieldia aculeata 426  
 Hydnocarpus 426  
 Hymenodiction excelsum 428, 429  
 Hypericineae 445, 446  
 Hypericoideae 446  
  
 Itea 424  
 Itea macrophylla 424  
     macrophylla var. minor 424  
 Iteadaphne confusa 427, 435  
  
 Juglandales 441  
 Juglandaceae 440, 441, 443  
  
 Kätzchenblütler 441  
 Kibara 426  
 Kibessia 417, 418  
     azurea 417  
  
 Lagerstroemia 434, 447  
     ovalifolia 433  
     speciosa 433  
  
 Lasianthus 427  
     purpurea 427  
 Laurales 426  
 Laurineae 427, 428, 431, 433, 435, 436, 437, 440, 442  
 Leea angulata 430  
     javanica 430  
     sambucina 430  
     sundaica 430  
 Leguminosae 410, 411, 412, 413, 435, 443, 444, 450, 451, 452, 453, 454, 455, 456  
 Ligustrum glomeratum 442  
 Lindera bibracteata 427, 435  
 Litsea 433  
     chinensis 427, 433  
     chinensis var. littoralis 427, 433  
     citrata 427, 437  
     diversifolia 427, 428  
     tomentosa 427, 433  
 Loganiaceae 431, 432, 436, 450  
 Loganiales 432, 433, 440, 441  
 Lumnitzera 445  
     coccinea 412, 450  
     racemosa 412, 450  
     racemosa var. pubescens 412, 450  
 Lunasia costulata 449  
 Lythrales 442, 449  
 Lythraeae 429, 430, 433, 434, 436, 437, 440, 441, 442, 443, 447, 448, 449  
  
 Macropanax 428  
 Maesa forbesii 426  
 Magnoliaceae 414, 426  
 Magnoliales 426  
 Malvaceae 419, 429, 443, 444, 450, 451  
 Malvales 420, 429, 438, 439, 440, 441, 442, 444, 448, 452, 456  
 Malvineae 429  
 Mangifera 452  
 Marlea 443  
     javanica 426, 443  
 Maoutia diversifolia 437  
 Mastixia 424  
 Medinilla 418  
     javanensis 417, 430  
 Melanochyla tomentosa var. glabrescens 452  
 Melastoma 418  
     asperum 417, 430  
     lanuginosum 417, 430  
     molkenboerii 417, 430  
     setigerum 417, 430  
 Melastomaceae 410, 417, 418, 429, 430, 441  
 Melia 448, 453  
     azedarach 447, 454  
     azedarach var. javanica 447, 454  
     bogoriensis 447, 454  
     composita 447, 454

- Meliaceae 410, 411, 412, 413, 423, 441,  
 445, 446, 447, 448, 449, 452, 453,  
 454, 455, 456  
 Meliales 431, 445, 446, 447, 448, 456  
 Meliosma 426  
 Melochia indica 437  
 Memecyloideae 418  
 Memecylon 418  
   excelsum 417  
   floribundum 417  
   intermedium 417  
   laevigatum 417  
   oligoneurum 417  
   paniculatum 417  
 Microcos 420  
   paniculata 420  
 Micromelum pubescens 447, 448, 455  
   pubescens var. denticulata 447, 448,  
   455  
 Mimosaceae 457  
 Monimiaceae 426  
 Monochlamydeae 441, 448  
 Moringeae 443, 444  
 Moringineae 444  
 Mouriria 417  
 Murraya exotica var. sumatrana 445,  
 447, 448, 449, 450  
 Mussaenda frondosa 429  
 Myrica javanica 427  
 Myricales 427  
 Myristica 426  
 Myristicaceae 426, 427  
 Myrsineae 426, 427, 431, 441, 443, 444  
 Myrtaceae 417, 428, 437, 438, 439, 440,  
 441, 442, 443  
 Myrtales 418, 430, 438, 439, 441, 442,  
 448, 450, 456  
 Myrtiflorae 437, 439, 441, 448, 456  
 Nyssa 424  
 Ochrosia 428  
   ackeringae 428  
   salubris 428  
 Olacales 422, 438  
 Olacineae 421, 422, 423, 424, 426, 428,  
 437  
 Olaceae 431, 439, 440, 441, 442, 443  
 Orchipeda grandifolia 432, 433  
 Oroxylum indicum 451, 453, 456  
 Papilionaceae 444, 457  
 Parietales 423, 439, 441, 442, 444, 448,  
 450  
 Passiflorales 441  
 Peltophorum ferrugineum 411  
 Pentace polyantha 448, 455  
 Personales 438, 450  
 Phaleria capitata 453  
 Picroasma 454  
   javanica 454  
 Pithecellobium 413  
   monoliferum 411, 413, 453  
 Pithecolobium, v. Pithecellobium  
 Pittosporaceae 435  
 Pittosporum 435  
 Platea 422, 424  
   excelsa 422  
   latifolia 422  
   parvifolia 422  
 Polemoniales 444  
 Polygaleae 428, 436  
 Polygalineae 436  
 Polyosma 424  
   ilicifolia 424  
   integrifolia 424  
   integrifolia forma subdenticulata  
   424  
   mutabilis 424  
 Polypetales 414, 423, 424, 430, 432,  
 439, 441, 444, 445, 446, 448, 450,  
 451, 456  
 Polyscias nodosa 437  
 Pometia pinnata var. javanica 411, 412  
   tomentosa 411, 412  
 Premna cyclopedia 433  
   foetida 433  
   leucostoma 433  
   rotundifolia 433  
   tomentosa 433  
 Primulales 444  
 Protium javanicum 433  
 Psychotria 433  
   aurantiaca 432, 4233  
   robusta 432, 433  
   viridiflora var. macrocarpa 432, 433  
 Pterospermum diversifolium 438, 443  
   javanicum 438, 443  
   javanicum var. montanum 438, 443  
 Putranjiva roxburghii 415  
 Pygeum 437  
 Pyrenaria lasiocarpa 425  
   serrata 425  
 Ranales 426  
 Rauwolfia 428  
   reflexa 428  
   sumatrana 428  
 Rhamnaceae 450, 451, 452, 454, 456  
 Rhampales 431, 438, 441, 450, 452, 456  
 Rhizophora 427  
 Rhizophoraceae 426, 427, 428  
 Rhoeadales 444  
 Rosaceae 428, 436, 437, 440, 441, 442  
 Rosales 430, 441, 442, 444, 451, 452, 456  
 Rubiaceae 427, 428, 429, 430, 431, 432,  
 433, 437, 441  
 Rubiales 428, 430, 432, 433  
 Rutaceae 444, 445, 446, 447, 448, 449,  
 450, 452, 454, 455, 456  
 Rutales 431, 445, 446, 447, 448, 450,  
 452, 456



- Sabiaceae 426  
 Samydaceae 415, 416, 431, 432  
 Sandoricum 453  
     indicum 447, 448, 454, 455  
     nervosum 447, 448, 454, 455  
 Sapindaceae 410, 411, 412, 413, 431,  
     434, 435, 441, 447, 448, 449, 450,  
     451, 452, 454, 456  
 Sapindales 431, 432, 435, 440, 441, 447,  
     448, 449, 450, 451, 452, 456  
 Sapindus rarak 412  
 Sapotaceae 416, 423, 436, 437, 438, 440,  
     442  
 Saurauia 423  
 Saurauiaceae 423  
 Saxifragaceae 421, 422, 423, 424, 426  
 Schleicheria trijuga 435  
 Schoutenia 420, 421  
     buurmanni 420, 421, 438  
     ovata 420, 421  
 Scolopia roxburghii 415  
 Scrophularineae 416, 436, 437, 438  
 Semecarpus 442, 443  
 Simarubaceae 447, 448, 452, 454, 455,  
     456  
 Siphonodon celastrineus 432, 433  
 Sonneratia 434, 447  
 Sonneratiaceae 429  
 Sphragidia 419  
 Staphyleaceae 421, 423, 424  
 Sterculiaceae 419, 429, 436, 437, 438,  
     439, 440, 441, 442, 443  
 Sterculia foetida 438  
 Stereospermum glandulosum 453  
     hypostictum 453  
 Streblus asper 435, 439  
 Strombosia membranacea 426  
 Styracaceae 421, 422, 423, 424  
 Styrales 422  
 Styrax benzoin 424  
 Sympetalae 432  
 Symplocaceae 422, 423  
 Symplocos 422, 423, 424  
  
 Tabernaemontana sphaerocarpa 423, 433  
 Tamoneae 418  
 Taractogenos blumeana 426  
 Tarrietia sumatrana 438  
 Tectona grandis 434  
 Terminalia 413  
     bellerica var. laurinioides 412, 413,  
         453, 454, 455  
     bialata 412, 413, 453, 454  
     catappa 412, 453  
     javanica 412, 453  
     teysmannii 411, 412, 413, 453, 454  
  
 Ternstroemia 414, 425  
 Ternstroemiaceae 414, 421, 422, 423,  
     424, 425  
 Tetrameles nudiflora 443  
 Thalamiflorae 423, 429, 439, 441, 444,  
     446, 448, 450, 456  
 Theales 423, 438, 439, 442, 456  
 Theineae 423  
 Thymelaeaceae 452, 453, 454, 455  
 Tiliaceae 419, 420, 421, 429, 435, 436,  
     437, 438, 440, 441, 442, 443, 447,  
     448, 449, 452, 453, 455, 456  
 Tiliales 429, 438, 439, 441, 442, 447,  
     449, 452, 456  
 Trevesia sundaica 435  
 Trichospermum javanicum 437  
 Tricoccae 436, 448, 456  
 Tubiflorae 438  
 Turpinia 423, 424  
     parva 421, 423  
     parvifolia 423  
     pomifera 421  
  
 Umbellales 441  
 Umbelliferae 431, 435  
 Umbelliflorae 437, 441, 442  
 Unisexuales 441, 448  
 Urticaceae 431, 435, 436, 437, 439, 440,  
     441, 443, 445, 446, 450, 451  
 Urticales 441  
  
 Vacciniaceae 421, 425, 427, 428  
 Vaccinium lucidum 421, 425  
 Verbenaceae 431, 433, 434  
 Vernonia 433, 437  
     arborea var. javanica 433, 437  
 Viburnum 414, 422, 424, 425  
     coriaceum 421, 424  
     sambucinum 421, 424  
     sundaicum 421, 424  
     sundaicum var. latifolia 421, 424  
 Violariceae 416, 426, 427, 428, 432  
 Vitex 433  
 Voacanga 432  
  
 Walsura pinnata 446  
 Weinmannia blumei 424  
 Wightia gigantea 438  
 Wikstroemia junghuhniana 453, 455  
  
 Xerospermum noronhianum 413  
  
 Zanthoxylum budrunga 449  
     budrunga f. puberula 449  
     budrunga var. paucijuga 449  
 Ziziphus jujuba 451, 454

## THE VARIABILITY OF THE WOOD-ANATOMY IN LARGE AND SMALL GENERA

by

H. H. JANSSONIUS

(Amsterdam)

---

In the "Mikrographie des Holzes der auf Java vorkommenden Baumarten" I described 991 kinds of wood. Several of these belong to large genera, the majority to small. I found remarkably wide variations in the wood-anatomy of several specimens belonging to a single species of a large genus. These intraspecific differences in large genera are generally larger than interspecific differences in small genera.

When identifying species by means of wood-anatomical characters, the wide intraspecific variability in large genera obstructs identification whereas in small genera identification is usually relatively easily executed. As a result, it is much easier to compose a key to the species in a small genus than in a large one. In my key to the Javan woods (Anatomische Bestimmungstabelle für die javanischen Hölzer, 1940, 83) it is repeatedly demonstrated; also in Mikrographie paßsim that taxonomic relationships are often blurred by this peculiar circumstance.

Several recent authors, when describing Malaysian species as a morphological group, pay considerable attention to intraspecific variability, but from their studies it does not become apparent that the intraspecific variability of large genera is often so strikingly wider than it is in small ones. It seemed useful to summarise the data now found scattered in the "Mikrographie".

*Dysoxylon* and *Aglaiia* (Mel.; cf. Mikrogr. 2, p. 119, § 2). I examined 21 species and varieties of *Dysoxylon*. I observed that the individual wood samples differed among each other nearly as much as the species. I examined 16 species and varieties of *Aglaiia* and found that the distribution of metatracheal wood parenchyma (an important characteristic of various groups) varies as widely among the several wood samples of a single species and even in different parts of the same sample as is found elsewhere among species. Koorders & Valetton comment hardly on the variability in *Dysoxylon* and not at all in *Aglaiia* (Bijdragen 3, 1896, 31—97 and 125—178).

Of *Eugenia* (Myrt.), a very large genus, I examined 44 species and varieties. Koorders & Valetton found that several species vary strongly, are polymorphic and form a "congregatio" (Bijdragen 6, 1900, 43—164). I found as a rule that the wood-anatomy varied accordingly (cf. Mikrographie 3, p. 396, § 2).

Regarding the species of *Myrsine* (*Myrs.*), another large genus, I stated after the examination of 4 species, that the several wood samples of one species were often more different from each other than the samples of different species (Mikrogr. 4, p. 299, § 2). This is in agreement with the results of Koorders & Valetton.

In *Laurineae* (Mikrogr. 5, p. 94, § 2), I found the same phenomenon in the larger genera. Of *Litsea*, I examined 25 species and varieties and samples of a single species were often nearly as different as samples relating from different species. Koorders & Valetton partly support this (Bijdragen 10, 1904, 123—192).

In *Euphorbiaceae* the woods of *Glochidion* proved to be intraspecifically so widely different that it became impossible to subdivide this large genus into smaller groups. J. J. Smith (in Koorders & Valetton, Bijdragen 12, 1910, 106) found *Glochidion* one of the most difficult genera of Indo-Malayan *Euphorbiaceae* because the species were so widely variable and their characteristics so difficult to define.

Of *Ficus* (*Urtic.*) I examined 43 species and varieties. The number of septate and non-septate libriform fibres is widely variable within these species (Mikrogr. 6, p. 98—232). I attached little weight to this character and 42 of the 43 kinds of *Ficus* are found in 2 places of my key (cf. Anat. Best. tab. jav. Hölz., also footnote 3, p. 61) owing to the division made under Number 216. Koorders & Valetton comment on the variability of only a few species and think it of small importance (Bijdr. 9, 1906, 31—274).

When summarising my results in *Quercus* (*Cupul.*) I noted (Mikr. 6, p. 371) that the 25 species and varieties I examined could not be arranged into distinct groups for wood-anatomical reasons. I found that the differences in wood-structure between species were often small, and the differences among samples within one species were very large. Koorders & Valetton hardly find a similar variability (Bijdr. 10, 1904, 12—65).

In *Engelhardtia* (*Jugl.*), of which I studied 2 species and 3 varieties, I observed a similar variability as that occurring in many large genera. Koorders & Valetton (Bijdr. 5, 1900, 162—177) more or less support my views (cf. l. c., p. 164!).

It appears now that all these variable species belonging to large genera have a similar type of wood structure. The ground mass is libriform, often septate, fibres having either simple and numerous pits or bordered and few pits. The division walls of the vessels are generally only little slanting; in the majority of the species they show all simple perforations, in the rest next to simple perforations also some with scalariform perforations. The number of cells composing the wood parenchyma strands is nearly always much larger than four.

American authors, in particular, have connected phylogeny with wood anatomy (cf. e. g. O. Tippo in Amer. Midl. Nat. 36, 1946, 362—372 and Trop. Woods 89, 1947, 66). These larger genera, according to these views, would show a less primitive wood-structure.

It may be suggested, as has actually been done, that the larger genera are more recent than the small, and that the former are so much



more variable because no (or few) linking forms and species are extinct, whereas in the latter case many intermediate species have disappeared. It is difficult to imagine why this should have happened; species having practically the same structure seem to be best suited to survive together, if surviving at all.

---

# THE VESSELS IN THE WOOD OF JAVAN MANGROVE TREES

by

H. H. JANSSENIUS

(Amsterdam)

In the course of my study on the wood-anatomy of Javan woods (Mikrographie des Holzes der auf Java vorkommenden Baumarten), I examined also many woods from mangrove-trees.

Mangrove has been the subject of much investigation; the community is usually described as xeromorphic. Mangrove woods proved to be different from woods belonging to species growing in other stations even if those species belonged to the same family or even genus. The data may be traced in my "Mikrographie" but it seems more convenient to review them here.

It is currently believed that the area occupied by the wood vessels to the mm<sup>2</sup> in transverse section is an indication of the water supply towards the higher parts of the tree. When comparing mangrove and non-mangrove species of one genus or of one family, it appears that the number of vessels to the mm<sup>2</sup> is much larger in the former. This was demonstrated in my "Mikrographie" and it was further confirmed by Panshin (Philipp. J. Sci. 48, 1932, 143). In the mangrove species, however, the diameter of individual vessels in transverse section is considerably smaller. Surface calculations show that notwithstanding this smaller diameter the total area occupied by the openings of the vessels in mangrove woods is generally distinctly larger.

I have composed some tables from the data found in the "Mikrographie". The mangrove species have been indicated with an asterisk, the capitals R and T indicate the radial and tangential diameters.

TABLE 1.

*Combretaceae* (Mikrogr., vol. 3)

diam. in $\mu$ R                  T	vessels per mm <sup>2</sup>	Species and varieties
50—210      65—185	3—6	<i>Terminalia bellerica</i> var. <i>laurinoides</i> , <i>T. javanica</i> , <i>T. bialata</i>
"                  "	c. 7	<i>T. catappa</i>
"                  "	→ 15	<i>T. teijsmannii</i>
25—90      40—100	40—75	* <i>Lumnitzera coccinea</i> , * <i>L. racemosa</i> , * <i>L. racemosa</i> var. <i>pubescens</i>

TABLE 2.

*Lythraceae* (Mikrogr., vol. 3)

diam. in $\mu$ R	T	vessels per mm <sup>2</sup>	Species and varieties
90—225	65—135	5—8	<i>Crypteronia paniculata</i> , <i>C. paniculata</i> var. <i>leptostachya</i>
40—320	50—360	5—10	<i>Lagerstroemia speciosa</i> , <i>L. ovalifolia</i>
130—400	130—330	4—5	<i>Duabanga moluccana</i>
35—175	45—130	35—50	* <i>Sonneratia acida</i> , * <i>S. alba</i>

The species of *Sonneratia* show the same figures although *S. alba* seems to occur further from the beach (reefs) than *S. acida* (A. Kint in De Trop. Nat. 23, 1934, 173; F. Grewe in Wiss. Veröff. Deutsch. Mus. f. Länderk., Neue Folge 9, 1941).

TABLE 3.

*Rhizophoreae* (Mikrogr., vol. 3)

diam. in $\mu$ R	T	vessels per mm <sup>2</sup>	Species and varieties
25—100	45—105	20—25	* <i>Rhizophora conjugata</i>
"	"	→ 45—50	* <i>Rhizophora mucronata</i>
55—120	60—115	c. 13	* <i>Bruguiera eriopetala</i>
"	"	→ c. 25	* <i>Bruguiera caryophylloides</i>
"	"	→ 25 ←	* <i>B. gymnorrhiza</i>
"	"	→ 30—40	* <i>B. parviflora</i>
50—180	50—185	c. 9 or c. 17	<i>Carallia integerrima</i>
90—270	125—230	c. 7	<i>Gynotroches axillaris</i>
"	"	c. 10—12	<i>G. axillaris</i> var. <i>obtusa</i>

TABLE 4.

*Meliaceae* (Mikrogr., vol. 2)

diam. in $\mu$ R	T	vessels per mm <sup>2</sup>	Species and varieties
25—300	20—270	c. 5	<i>Melia azedarach</i> , <i>M. azedarach</i> var. <i>javanica</i> , <i>M. composita</i>
"	"	→ c. 10	<i>Melia bogoriensis</i>
30—140	60—110	c. 10	<i>Sandoricum indicum</i> , <i>S. nervosum</i>
25—200	40—110	8—15	<i>Dysoxylum densiflorum</i>
"	"	→ 25	<i>D. densiflorum</i> var. <i>minor</i>
"	"	→ 10	<i>D. caulostachyum</i>



TABLE 4 (continued).

diam. in $\mu$ R                  T		vessels per mm <sup>2</sup>	Species and varieties
25—200	40—110	5—10	<i>D. ramiflorum</i>
"	"	c. 5	<i>D. excelsum</i> , <i>D. excelsum</i> var. <i>parvifolia</i>
"	"	8—15	<i>D. hasseltii</i> , <i>D. macrocarpum</i> , <i>D. alliaceum</i> , <i>D. alliaceum</i> var. <i>lanceolatum</i> , <i>D. alliaceum</i> var. <i>pauciflorum</i> , <i>D. arborescens</i> , <i>D. amooroides</i> var. <i>otophora</i> , <i>D. amooroides</i> var. <i>pubescens</i> , <i>D. amooroides</i> , <i>D. mollissimum</i> , <i>D. nutans</i> , <i>D. blumei</i>
"	"	c. 5	<i>D. mollissimum</i> var. <i>teysmannii</i> , <i>D. simile</i>
30—200	50—160	c. 25 c. 10	<i>D. biloculare</i> <i>Chisocheton sandoricocarpus</i> , <i>Ch. microcarpus</i>
"	"	c. 5	<i>Ch. divergens</i> , <i>Ch. macrophyllus</i>
25—220	70—200	10—15	<i>Amoora aphanamixis</i>
40—150	60—160	c. 15	<i>Lansium humile</i> , <i>L. javanicum</i>
50—160	75—140	c. 15	<i>Aglaia argentea</i> var. <i>cordulata</i> , <i>A. argentea</i> var. <i>multijuga</i> , <i>A. odoratissima</i> , <i>A. odoratissima</i> var. <i>parvifolia</i> , <i>A. heptandra</i> , <i>A. aspera</i> , <i>A. latifolia</i> , <i>A. acida</i> , <i>A. roxburgiana</i> , <i>A. roxburgiana</i> var. <i>balica</i> , <i>A. elaeagnoidea</i>
"	"	→ 10	<i>A. argentea</i> var. <i>splendens</i> , <i>A. eusideroxylon</i>
"	"	c. 8 or c. 15	<i>A. ganggo</i>
20—100	30—80	c. 30	<i>Walsura pinnata</i>
25—110	30—90	15—25	* <i>Carapa obovata</i> , * <i>C. moluccensis</i> , * <i>C. moluccensis</i> var. <i>elliptica</i> , * <i>C. moluccensis</i> var. <i>obtusifolia</i>
15—420	35—290	c. 3	<i>Cedrela febrifuga</i> , <i>C. febrifuga</i> var. <i>glabrior</i> , <i>C. febrifuga</i> var. <i>velutina</i>

It is to be noted that the radial and tangential diam. of the vessels in *Aglaia argentea* var. *splendens* are wider than indicated in the table; in *A. eusideroxylon*, and *A. heptandra* both diameters are somewhat narrower.

In *Urticaceae* I examined *Streblus asper* which has been said to occur in temporarily very dry stations and also in mangrove. I found far more numerous and narrower vessels in its wood than in closely related species of the same family.

In *Euphorbiaceae*, *Excoecaria agallocha* is a mangrove tree. *Ex-*

*coecaria virgata* is not found in the mangrove. The former has 9 to 14 vessels to the  $\text{mm}^2$  in transverse section, the widest are radially  $105\ \mu$  and tangentially  $80\ \mu$ . In the latter occur 3—6 vessels to the  $\text{mm}^2$  in transverse section, the radial diam. is  $30\text{--}185\ \mu$  and the tangential diam. 40 to  $150\ \mu$ .

In *Rubiaceae* I examined 5 species of *Ixora*. Only one species, *I. paludosa*, grows in saline soils (Koorders & Valetton, Bijdr. 8, 1902, 156), in the inner zone of the mangrove. *Ixora paludosa* has 65 vessels to the  $\text{mm}^2$  in transverse section. The 4 other, non-mangrove species have resp. 20—30, c. 40, c. 50 and c. 45—55 vessels to the  $\text{mm}^2$ . It may be noted that the species of *Ixora* alluded to in this here which has c. 45—55 vessels to the  $\text{mm}^2$  (*I. grandifolia*) is a species occurring on rocks on the beach.

The remarkable increase in number and in total area of the vessels in the wood of mangrove trees suggests that the transpiration of the trees is accordingly larger. A high rate of transpiration was stated to exist by Von Faber (Jaarb. Dep. Landb., Nijv., Handel Ned.-Ind., 1913, 16; Ber. Deutsch. Bot. Ges. 31, 1913, 277; *ibid.* 41, 1923, 227), and Schimper (Pflanzengeogr. physiol. Grundl. 3rd ed., 1935).

On the other hand, Th. Arzt (Ber. Deutsch. Bot. Ges. 54, 1936, 259, footnote) wrote that he was informed by Prof. Dr Walter that the transpiration of mangrove plants was much lower than Von Faber believed it to be and that the data of Von Faber on the osmotic properties of mangrove species needed to be corrected also. He reached the conclusion that the xeromorphic habit of the mangrove leaves was more or less an expression of their ecological circumstances. This is supported by Walter and Steiner (Zeitschr. f. Botanik 30, 1939, 111) who find that mangrove species are referable to plants with a low rate of transpiration.

I think it probable that the resistance to the transport through the narrower vessels is considerably larger than expected. It seems likely that the perforation rims of the division walls in the narrower vessels may offer additional resistance to the transport of water.

In this connection I wish to refer to J. H. de Haan's work on the mangrove forests of Tjilatjap (Tectona 24, 1931, 39). He divided the mangrove area into zones which are different by the number of days of inundation monthly. The three species of *Bruguiera* are confined each to a different zone. *B. parvifolia* grows in the area inundated 10—20 times monthly, *B. gymnorrhiza* in the area inundated 9 times (or less) monthly, and *B. caryophylloides* only in rarely inundated areas. I found a correlation between the number of vessels and the frequency of inundation. The more frequent the area is inundated in which the species grows, the larger the number of vessels to the  $\text{mm}^2$ .

De Haan refers both the *Rhizophora* species I examined to the same area of inundation (i.e., p. 49). He found, however, that *R. mucronata* dominates in an outer fringe and *R. conjugata* occupies the inner parts. *R. mucronata* has a distinctly larger number of vessels to the  $\text{mm}^2$  than *R. conjugata*.

Anna M. Starr (Bot. Gaz. 54, 1912), in her study on the comparative anatomy of dune plants concluded that there was a tendency for the vessels to be larger in the mesophytic forms, more numerous in the xero-

phytic ones, the area still being greater in the xerophytic (p. 301), and she stated in addition: "plants generally growing in mesophytic situations, when found also on the dunes, show the following modifications: of the stem, increase in the number of vessels and in the area of their cross-section giving greater conductive space."

*Ficus pisifera*, as regards its wood, was described in "Mikrographie" vol. 6, p. 190. It is nearly always epiphytic; only on very dry soils it may become terrestrial. It is a xeromorphic species (Koorders & Valetton, Bijdragen 9, 1906). Compared with related non-epiphytic species, it shows the same characters as mentioned above.

The mangrove species vary as regards their general wood-structure, their woods belong to different types.

---



## MADAGASCAR AND NEW CALEDONIA

### A problem in plant geography

by

RONALD GOOD, M.A., Sc.D.

(Dept. of Botany, University College of Hull).

A perusal of the most recent full-length presentation of the Angiosperms, the great and valuable compilation of Lemée (1), recalls vividly to mind a point of plant geography which, though familiar enough, has scarcely received the critical consideration it deserves, namely the not infrequent association, in matters phytogeographical, of Madagascar (and the other islands of the western Indian Ocean) and New Caledonia, two regions which from their relative positions would hardly be expected to show any considerable relationship.

This is because Lemée pays particular attention to both these areas, doubtless because they are both French possessions, but they are also areas of exceptional phytogeographical interest and although political circumstances may perhaps have increased the similarities of their adventive floras, they can scarcely be held responsible for any resemblances which may exist between their native floras.

But the political relation is not the only one between the two and there are other parallels which may have greater botanical significance. The relative situations and shapes of the two main areas are alike: both lie at the same south latitude at very roughly the same sort of distance east of a continental land-mass, and have no appreciable land eastwards of themselves for thousands of miles: both are rather alike in shape though not in orientation or size, Madagascar being thirty times as extensive as New Caledonia. Their physiographic structure is also curiously similar, the eastern two-thirds or so of each being of igneous rocks rising to a considerable elevation, and the western parts being covered with Permian or younger sedimentary rocks. Largely because of these various similarities the climatic values also correspond notably.

How far these resemblances may be genetical in any real sense is a matter for geologists but they certainly reinforce the impression left by Lemée's work that an attempt to discover how far a floristic relation exists between the two is well worth making. To do this exhaustively would necessitate a careful and complete systematic study of both floras but a preliminary answer to the question can be given by something a good deal less ambitious and laborious, namely a brief geographical analysis of the flora of the smaller, New Caledonia, in certain particular

ways and with special reference to the larger, and such an analysis is the subject here.

Although it has been convenient so far to speak rather of Madagascar only, all the islands of the East African Island Region, namely the Comoros, the Seychelles and the Mascarenes in addition, are concerned in the problem, and hereafter the term Madagascar, unless qualified, is used in this wider sense to include them all. The phytogeographical data quoted may be assumed, in absence of any definite reference, to be derived from such general sources as the first edition of the "Pflanzenfamilien", "Index Kewensis" and Lemée's "Dictionnaire".

### The Flora of New Caledonia.

The flora of New Caledonia has long aroused interest as one of the richest and most peculiar in the world, but the chief more modern sources of information about it are the accounts of the explorations there of Sarasin and Roux (2) and of Compton (3, 4) and the many systematic studies of Guillaumin (5). The first of these in particular contains, from the pen of the last-named, a detailed analysis of the flora, especially from the floristic point of view, in which its general features are well displayed and the conclusion reached that it is mainly Australian in relationship; that it contains also approximately equal Malaysian, Papuan and Polynesian elements; and that there are also distinct but more distant relationships with South Africa and South America. Unfortunately in these comparisons Madagascar receives no particular mention except for the statement that it is the only place with a higher degree of endemism than New Caledonia, a point perhaps not altogether unrelated to our present problem.

From the various sources that have been mentioned it is possible to build up a reasonably complete annotated list of the genera of New Caledonia and this list is considered below in two ways calculated to reveal something at least of any relationship with Madagascar which there may be and to warrant some conclusion on the question at issue.

The list contains over 800 genera, including adventives, and this is of course only one expression of various taxonomic conceptions but since it is not necessary to make the analyses here strictly quantitative this imponderable factor need not cause undue concern.

The genera in the list can first be divided into three:

1. Genera of wide distribution represented in New Caledonia by wide (not endemic) species only. These include some special types such as strand plants, and many others are doubtless adventives.
2. Genera not endemic to New Caledonia but represented there by endemic species.
3. Genera endemic to New Caledonia.

It is scarcely likely that any prolonged consideration of the first of these will be profitable if only because of the uncertainty of the status of many of its members in the island. It is, moreover, the 'expected' element of the flora, that may be anticipated simply having regard to the position of the island in the south-eastern part of the Old World

tropics. For both these reasons no more need be said about it here, though this is not to suggest that it is quite without interest. The second and third, on the other hand, are clearly of considerable possible significance because they constitute the characteristic part of the flora, and to these careful attention must be given.

### The genera with endemic species in New Caledonia.

The number of genera not themselves endemic to New Caledonia but which have endemic species there appears to be about 250 and these can be sorted into the following four categories:

1. Wide, often pantropical genera, with endemic species well scattered over their ranges, amount to about 24 %.
2. Asiatic-Australian-Polynesian genera of Asiatic preponderance amount to about 20 %.
3. Asiatic-Australian-Polynesian genera of Australasian preponderance amount to about 28 %.
4. Others, amounting to about 28 %.

Of these four the first may reveal facts of interest if and when the detailed affinities of individual species are worked out but otherwise is not likely to help our enquiry much. Similarly the second and third can be passed over here without attention because they do not occur in Madagascar. The fourth category, on the other hand, is the crucial one.

When the 75 or so genera of this fourth category are examined it is found that all save one or two of them either belong to one or other of four types of distribution, or are so similar in some significant way that they can be treated as anomalous examples of them.

A. The first of these is the African-Asiatic-Australasian, or 'Old World', type as it may be called because its genera are found in Africa as well as further east and thus, in their fullest expression, cover all the tropics of the eastern hemisphere. It might be expected, considering the considerable total number of genera of this sort, that this would be the largest group, as indeed it is, but even so it amounts to only twenty genera of which three are doubtful, and this is tantamount to saying that of the many Old World tropical genera only a very few have endemic species in New Caledonia. The explanation of this seems to lie in the fact that, with two dissimilar exceptions, the seventeen satisfactory genera are moderately large genera with most of their species either in both Africa and Indo-Malaya or in the latter only, suggesting that they are genera of the northern tropics which have spread southward. The genera of these two kinds are, respectively, *Albizzia*; *Garcinia* (7); *Grewia*, strongly represented in Madagascar; *Macaranga* (7), well represented in Madagascar and in Australasia and slightly anomalous because most of the Asiatic species are in the southern part of the Malay Archipelago; *Maesa*; *Plectronia*; *Scolopia* (7); and *Secamone*, well represented in Madagascar, on the one hand, and *Cleistanthus* (7), in which the species of Africa and of Madagascar form a single section of the genus; *Harpullia* and *Hetaeria*, which are but slightly represented in Africa; *Loranthus* (7); *Pandanus*; *Phajus*; *Syzygium*; and *Tylophora*.



The two exceptions are *Flagellaria* and *Helichrysum*. The former has one species in Fiji and Samoa, one in New Caledonia, and one throughout the Old World tropics (7), but Thonner (6) says it has economic uses in Africa, which might mean that it is not native there. Neither source mentions it for Madagascar.

*Helichrysum* is of special interest. The geography of Composite genera is notoriously difficult but *Helichrysum* is clearly marked as a southern genus, as are all its immediate relations in the *Gnaphalieae*. At least half its species are South African; tropical Africa has a considerable number; there are more than this in Madagascar; and more still in Australia. It is interesting too to note that the New Caledonian species belongs to the Australian section *Ozothamnus* and was the first endemic Composite to be described from the island (11).

The three other genera are *Gymnosporia*, which if rightly considered as having endemic species in New Caledonia merely adds another to the genera that are predominantly Indo-Malayan; *Oberonia*, which is variously interpreted but included here on the authority of Thonner (6), is another predominantly Indo-Malayan genus; and *Schefflera* which may be noted, but about which little useful can be said.

B. The second is the *Asiatic-Australasian-American* type, in which the genera, though comparatively widely distributed, do not occur in Africa and/or Madagascar. There are about a dozen such, and although they are of somewhat less interest here because of their absence from Madagascar, they call for short notice. The best and most familiar instance is *Symplocos*, the only genus of its family, though *Erythroxes* has a very similar range. *Lucuma* and *Roupala* are chiefly American and in the Old World restricted to Australia and New Caledonia: *Licania* and *Calycorectes* are similar but absent from Australia. The New Caledonian species of the latter are sometimes reckoned as an endemic genus *Spermolepis*. *Litsea* is rather the converse, having but few American species.

Other less typical genera associated with this group are, *Cleidion* (7), which is said to have a single species in Africa; *Myrtus*, a puzzling genus which occurs in the Mediterranean region and has perhaps a South African representative; *Santalum*, the New Caledonian species of which has now been recorded also from the New Hebrides, and which is represented in the New World only on Juan Fernandez; and *Osmanthus*, in which an endemic species from New Caledonia has been named.

Lastly *Oxalis* may be mentioned. This is another predominantly southern genus with its highest species concentrations in South America and South Africa, but the New Caledonian members constitute a special section among American sections (7).

C. The third type is really an extension of the last because it includes the genera that are found in *Asia-Australasia-America* and also in *Madagascar*, though not in *Africa*, and is of outstanding interest here. Strictly speaking there seem to be only two genera of this kind, both familiar to plant geographers, namely *Weinmannia* (7, 8, 9), which is found on Madagascar itself, and *Astelia*, which, according to Skottsberg (8, 10), is found on Réunion, but there are other related con-

ditions. Species of *Ilex* have been described from Madagascar and from New Caledonia and the distribution of the genus will be referred to again later. *Polyscias*, one of the difficult Araliaceous genera, should perhaps be defined in a sense which would include it here. *Hernandia* is, according to Hutchinson (9) typical except that it occurs on Fernando Po and St. Thomé. *Calophyllum* (7) is a wide tropical genus, but the New Caledonian endemic belongs to a section which occurs in the New World and in Madagascar but which is absent from Africa.

D. The fourth and most important type is that in which the genera are found in Asia-Australasia and Madagascar only. In other words they are the Old World genera of New Caledonia which find their western limits somewhere in the islands of the western part of the Indian Ocean. First and foremost here there are the two genera said to occur only in New Caledonia and these islands, namely *Cohnia* (7, 8) and *Cossinia* (8). Both have their western stations in the Mascarenes and not in Madagascar proper. Whether or no these are in all respects good genera the fact remains that they show an extraordinarily close relation between the two regions and they are justifiably maintained here because it is thus that they most plainly show this relation. It may be added that the Cyperaceous genus *Lophoschoenus* has been credited with a similar range and may indeed properly belong here though the generic distinctions in this family are difficult.

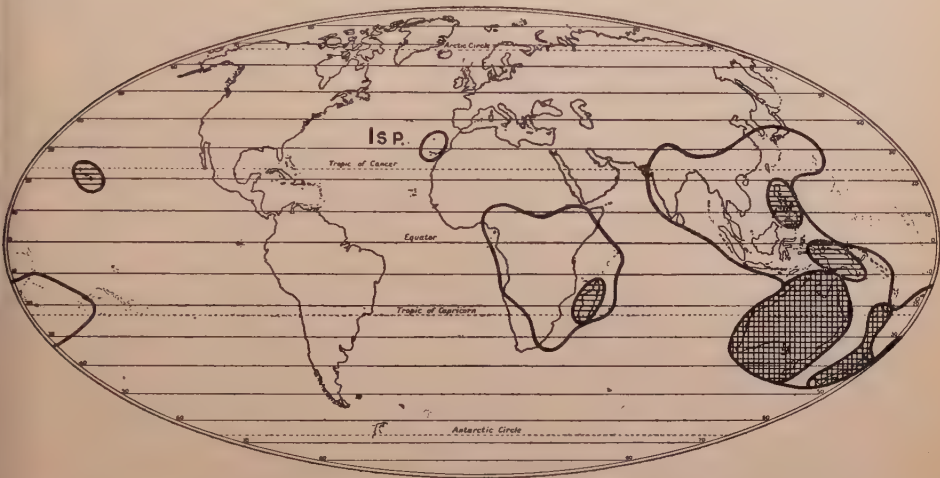
Other genera affording good examples of this type, though their wider occurrences in Australasia make them less conspicuous, are *Alyxia*, well developed in New Caledonia; *Soulamea* (7), with most species in New Caledonia; *Evodia* (7); *Myoporum*, predominantly Australian; *Geniostoma*, well developed in New Caledonia; *Ochrosia*; and *Timonius*. *Dianella* is often considered as another, and includes one species which ranges from Madagascar through India to Australia; Guillaumin (5) mentions 8 species from New Caledonia. *Tieghemopanax* and *Galeola* should perhaps be added but are confused. In *Calpidia* (7) one of the two sections (*Timeroya*) ranges from the Mascarenes to Polynesia.

Three other genera worth notice here are *Canarium* (7), *Homalium* (7) and *Acalypha* (7) because, although they occur in Africa, the species of New Caledonia and of Madagascar are in sections without African representatives, so that they illustrate this fourth type on a subgeneric scale.

Other related genera of significance here, though not strictly belonging to the type are *Cunonia* (7), which is exclusively Australasian except for one species in South Africa (compare *Myrtus*); *Acridocarpus*, said to have numerous species in South Africa but elsewhere only one in New Caledonia, and if this is so a striking converse to *Cunonia*; *Metrosideros*, which in one definition at least includes a species in Madagascar and one in South Africa; *Ventilago*, which occurs in Angola as well as in Madagascar; and *Barringtonia*, which reaches both Madagascar and the East African coast. *Goodyera* may in part also exemplify this type of distribution.

Apart from those just described there is really only one other genus having endemic species in New Caledonia to be discussed and this has been left till now because of its special interest. It is the genus *Pittosporum* and its distribution is shown in the map, which is based on

information in Pritzl's revision of the *Pittosporaceae* (7). It will be seen that although the genus occurs widely over tropical Africa and actually has one species in Macaronesia, so that it is really an additional Old World



Distribution of the *Pittosporaceae*, showing, by crossed lines, the areas of highest species concentrations, and by horizontal lines, secondary areas of high species concentration. Australia has 9 genera and 50 species, New Zealand—New Caledonia has 35 *Pittosporum* species, the Philippines, New Guinea, Madagascar and Hawaii have each 12—16 *Pittosporum* species.

tropical genus, it is so obviously and characteristically a Madagascar-Australasian group that it deserves separate recognition. The family is an outstanding instance of one whose fundamental relationships are all below the equator and of the nine genera of which it consists only *Pittosporum* occurs outside Australia.

### Summary.

The first result of this survey of the wide genera which have endemic species in New Caledonia is certainly to confirm the impression that there is indeed a noteworthy geographical association between Madagascar and that island, even if it is only a particular aspect of a more general relationship between Madagascar and Australasia as a whole.

But the survey gives prominence also to another point, namely the unexpectedly small part that tropical Africa plays in the distribution of the genera reviewed. It almost seems as if there is some factor of exclusion affecting that great region, and there is no indication of any corresponding degree of relation between tropical Africa and New Caledonia such as has been detected between the latter and Madagascar.



### The endemic genera of New Caledonia.

New Caledonia appears to have about 110 endemic genera and these can be roughly classified according to their affinities, that is to say according to their relationships with other genera of their families. When this is done rather more than half of them are seen to be related most nearly either to wide genera or else to Asiatic-Australasian genera, and are thus the counterpart of the three first categories on p. 472 above. These again no doubt contain points of interest in detail but are not of great significance in the present brief study. The remainder fall under three heads.

First, there are less than a dozen genera whose affinities appear to be unmistakably with plants of tropical Africa, namely *Alphandia*, *Anisomallon*, *Cyclophyllum*, *Gonatostyles*, *Lasiochlamys*, *Menepetalum*, *Montrouzeria*, *Normandia* and *Rhopalostachyum*.

Second, there are about a dozen genera whose affinities are the converse of the last, being chiefly with both Asia, Australia and with America, and which show a conspicuous lack of any association with Africa. The most striking of these perhaps are the three genera *Oncotheca*, *Phelline* and *Sphenostemon* of the *Aquifoliaceae*, a family which is almost entirely composed of the genus *Ilex*. The distribution of the described species of *Ilex* is very remarkable and may be set out as below in a way which roughly corresponds to their spatial distribution.

N. America 26	Europe, W. Asia, 5	China, Japan, 117
C. America 69	N. Africa etc.	Formosa
& W. Indies		Indo-Malaya 123
	? S. Africa 1	
Tropical S. 150		
America	Madagascar 1	Australia 1
		New Caledonia 1
Temp. S. America 3		
		Pacific Isl. 2

The other genera here are *Adenodaphne*, *Bonatia*, *Canacomyrica*, *Dutaillya*, *Exospermum*, *Morierina*, *Piliocalyx*, *Sarcomelicope* and *Zygogynum*.

The rest of the endemic genera bear more directly on the problem of Madagascar and can best be treated *seriatim*. The most striking are the dozen or so endemic genera of *Palmaceae* because all these belong to the comparatively small part of the family, the *Areceae*, which is found all over the family range except in Africa, and which is therefore a counterpart on a larger scale of the genera in the third type on p. 472 above. There are also four endemic genera of *Araliaceae*, *Dizygotheca*, *Eremopanax*, *Octotheca* and *Schizomeryta* which perhaps form a rather similar group.

*Arthroclianthus* finds a place among genera notably lacking in Africa, though one of them occurs in Madagascar; *Beauprea* and *Garnieria* are usually placed near genera from Madagascar and Tasmania; *Bocquillonina* belongs to a wide tropical group but is near an endemic genus of Madagascar; *Canaca* is in a group which is found in all the tropics (including

Madagascar, except Africa; *Greslania* finds a place among Asiatic genera of which one is also in Madagascar; *Loxodiscus* belongs to a group which is Madagascar-Asiatic except for one pantropical member; *Microsemma* is in a group with considerable representation in Madagascar but with one small genus in West Africa; *Podochrosia* and *Pterochrosia* are generally placed between genera from Malaysia and from Madagascar.

This brief survey of the endemic genera of New Caledonia was made in the hope that it would help to confirm or contradict the impression gained in earlier pages. It may fairly be said that it does so and supports the view that there is a greater degree of floristic affinity between Madagascar and New Caledonia than might be expected at first sight.

### Complementary notes on the flora of Madagascar.

Although, as explained earlier, this study is formally one of certain aspects of the New Caledonian flora, the conclusions so far reached make it desirable to consider, very shortly, whether there are any broad facts about the flora of Madagascar which give support to them, and the following facts are perhaps particularly relevant.

1. The proportion of endemic genera in Madagascar is very high, probably higher than anywhere else, even New Caledonia, and perhaps amounting to from 20 to 25 % of all native genera. It is difficult to arrive at a number but the data of Lemée indicate that the conservative estimate given by the present writer elsewhere (8) may be a good deal too low.

2. These endemic genera represent about 80 families and the order of these, when they are arranged according to the number of genera in each, is somewhat reminiscent of the order of families among the endemic genera of New Caledonia (2), e.g. *Palmaceae* and *Sapindaceae* are high in the list while *Compositae*, *Leguminosae* and *Gramineae* are unusually low.

3. The number of genera which are found in both Madagascar and Africa only is considerably less than the number of endemic genera in the former, and is but a small proportion of all the African genera. Moreover, the order of the families in these genera is notably different from that among the endemics, e.g. the *Compositae* are higher and the *Palmaceae* and *Bignoniaceae* much lower.

4. In addition to the endemic genera there is a notable total of other genera which are absent from Africa or north of it. Except for some half dozen found elsewhere only in America, and three in America and Australasia only, all these are found, outside Madagascar, only in Asia and/or Australia. These latter clearly comprise two types, in one of which the genera are predominantly Asiatic, and in the other of which they are predominantly Australasian, the former greatly outnumbering the latter.

### Conclusion.

It is important to realize that the various relationships which have been described in the foregoing pages are, often enough, the expression only of certain opinions regarding the classification of the plants concerned. Thus for instance when species from New Caledonia and from

Madagascar are united into a single genus the apparent affinity between the two regions is greater than it may appear to be if the respective species are placed in different genera. But this is a familiar difficulty in plant geography, and although on particular occasions it may be a very real one, in general it may be accepted that classification is more right than wrong and does express relationship and geographical affinity, if not in detail, then at least in broad terms. This being so the foregoing analyses may be treated as reasonably sound and objective and as expressing facts, even if the quantitative values attributed to them are open to modification.

If this opinion is accepted then two conclusions seem inescapable. The first is that there does indeed exist a floristic relationship between Madagascar and New Caledonia greater than can be accounted for merely by chance or coincidence, and, further, that this relationship is a particular aspect of a larger relation between the islands of the western Indian Ocean and Australasia in the wider sense. The second is that in some ways the peculiarities of the Madagascar flora are greater, and its affinities other than might be expected from its situation in respect of tropical Africa. Especially it seems to have more relationship with America and Asia-Australasia and less with Africa than might be anticipated. It is noteworthy that there is in the Madagascar flora the distinct impression of the presence of two floristic elements describable respectively as 'African' and 'non-African', and that a considerable part of the latter finds its affinities so distinctly below the equator as to merit the term 'southern'.

To postulate and maintain any particular explanation of these facts would need not only a much more detailed study than has been made here but would necessitate also, if the danger of arguing from the particular to the general is to be avoided, taking into due account many other facts of plant geography. Nevertheless it is perhaps permissible in conclusion to suggest one circumstance in which the facts described above would be considerably less formidable than they appear to be. This is the suggestion that Madagascar, instead of being primarily a recent dismemberment of middle Africa is rather primarily one of a series of land surfaces, including South America, Antarctica and Australia, which once, less separated than they are now, were the original home of a flora rather distinctive of the southern hemisphere. If this indeed should be the case, then the presence in the flora of Madagascar of an older 'southern' element, overlaid now by a younger but stronger 'African' element, is only what might reasonably be expected, and may throw light on some of the many problems of the antarctic regions which still await solution.



### Bibliography.

1. LEMÉE, A., 1929—1943, Dictionnaire descriptif et synonymique des genres de plantes phanérogames.
  2. SCHINZ, H. and A. GUILLAUMIN, in F. SARASIN and J. ROUX, 1921, *Nova Caledonia*, vol. I, Botany.
  3. RENDLE, A. B., E. G. BAKER and S. LE M. MOORE, 1920—1922, A systematic account of the plants collected in New Caledonia by Prof. R. H. COMPTON, M.A., in 1914 — *Journ. Linn. Soc., Bot.* Vol. 45, p. 245.
  4. COMPTON, R. H., 1917, *New Caledonia and the Isle of Pines* — *Geogr. Journ.*, Vol. 49, p. 81.
  5. GUILLAUMIN, A., 1946, *Materiaux pour la Flore de la Nouvelle Calédonie. Table des Articles* — *Bull. Soc. Bot. France*, Vol. 92, p. 76.  
——, 1948, *Flore analytique et synoptique de la Nouvelle-Calédonie. Phanérogames.*
  6. THONNER, F., 1908, *Die Blütenpflanzen Afrikas.*
  7. ENGLER, A., 1924—1943, *Die Natürlichen Pflanzenfamilien*, 2nd edition.
  8. GOOD, R., 1947, *The Geography of the Flowering Plants.*
  9. HUTCHINSON, J., 1926 and 1934, *The Families of Flowering Plants.*
  10. SKOTTSBERG, C., 1934, *Studies in the genus Astelia Banks et Solander* — *Kungl. Svenska Vet.Handl.*, 3rd ser., Vol. 14.
  11. SCHLECHTER, R., 1906, *Beiträge zur Kenntniss der Flora von Neu-Kaledonien* — *Engler's Bot. Jahrb.*, Vol. 39, p. 273.
-

# REVISION OF THE LYCOPERDACEAE OF THE NETHERLANDS

by

A. C. PERDECK

(Leiden)

(Issued 3. IV. 1950)

---

## Introduction.

For this study which was suggested to me and promoted by Dr R. A. Maas Geesteranus I had at my disposal the material of the "Rijksherbarium" at Leiden, the herbaria of the Universities at Amsterdam, Groningen and Utrecht, and those of the "Koninklijke Nederlandse Botanische Vereniging" and the "Natuurhistorisch Museum", Maastricht. I wish to express my thanks to the directors of these institutions for putting the material at my disposal, and above all to the staff of the "Rijksherbarium", who gave me a great deal of valuable help, especially Dr Joséphine Th. Koster, Dr Maas Geesteranus and Dr S. J. van Ooststroom. I am indebted to Dr H. C. D. de Wit for the solution of some intricate nomenclatural questions, to H. J. T. Tammel for drawing the figures.

Thanks to the presence of the herbarium of Persoon in the "Rijksherbarium" at Leiden, I was able to arrive at a better interpretation of a number of species described by him. This was especially important for the reason, that Persoon's "Synopsis Fungorum" of 1801 is the "starting-point" of nomenclature in the Gasteromycetes.

I use the name of *Lycoperdaceae* in the sense of Fisher in Engler-Prantl, Nat. Pflanzenfam., 2nd ed., vol. 7a, 1933, p. 62, thus excluding *Geastrum* and allies.

All descriptions are based upon specimens found in the Netherlands unless otherwise stated.

## History of the study of the Lycoperdaceae in the Netherlands.

To my knowledge nothing of scientific importance about the Netherlands *Lycoperdaceae* was published previous to 1866. It is true that statements of the occurrence of species may be found in literature, but they can not be verified because of the absence of authentic material and clear descriptions. I mention the following papers: Boerhaave, Index Alter Plantarum, 1720, p. 15; van Royen, Flor. Leyd. Prodr., 1740, p. 519; de Gorter, Fl. Gelro-Zutph., 1745, p. 203; Meese, Flor. Frisica, 1760, p. 85; de Gorter, Flor. Zutph., 1781, p. 86; Schuurmans Stekhoven, Kruidk. Handboek, 1818, p. 178; Dozy en Molkenboer, Tijdschr. Nat. Gesch. Physiol., vol. 11, 1844, p. 397; Gevers Deynoot et Abeleven, Flor. Noviomag., 1848, p. 154; van der Trappen, Bijdr. Neerl. Flora, 1852, p. 18.

In 1866 a revision of *Fungi*, including the *Lycoperdaceae*, in the *Prodromus Flor. Bat.*, 1st ed., vol. 2, pars 4, 1866, p. 12—15 was published by Westendorp. Thanks to the presence of much of the cited material in the Herbaria at Leiden, it was possible to decide what species were meant (only of no. 2878, *L. turbinatum* a. *lividum* Pers., no specimens were found).

The same may be said of the papers by Oudemans (*Ned. Kruidk. Archief*, ser. 2, vol. 1, 1874, p. 166; *Arch. Néerl.*, vol. 8, 1873, p. 253; *id.*, vol. 15, 1880, p. 369—373; *Révision Champ.*, 1892, p. 462—471; *Cat. rais.*, 1904, p. 38—40). He was the first to give a key with good descriptions (in his *Rév. Champ.*). Because of the absence of material I could not find out what he meant by *Lycoperdon foetidum* Bon. (*Ned. Kruidk. Arch.*, ser. 3, vol. 2, 1903, p. 199; *Cat. rais.*, 1904, p. 38). He described a new species, *Lycoperdon favosum* Oud., based on one specimen, which could not be found. (See p. 491.)

All interpretations I give of the species mentioned by Westendorp and Oudemans are based on the authentic specimens cited by them, unless otherwise stated.

After Oudemans practically no progress was made in the study of the Netherlands *Lycoperdaceae*. Strangely enough, the more modern foreign literature was never taken into account. I mention: Destrée, *Hand-leiding Hogere Zwammen*, 1901, p. 298—303; Cool en v. d. Lek, *Paddestoelenboekje*, 1st ed., 1913, p. 285, 317; 2nd ed., vol. 2, 1920, p. 233, 241; 3rd ed., vol. 2, 1935, p. 236; 4th ed., vol. 2, 1943, p. 252.

In 1938 a species, new for the Netherlands, *Disciseda bovista* (Klotzsch) Kambly was found. Van Eyndhoven (*Meded. Nederl. Mycol. Vereeniging*, vol. 27, 1942, p. 3) has given an excellent, critical and up to date review of that species.

The latest complete list of the Netherlands species is that by Oudemans (*Cat. rais.*, 1904, p. 38—40). It mentions 16 species of *Lycoperdon* and 2 of *Bovista*. They appeared to be 3 *Calvatias*, 6 *Lycoperdons* and 2 *Bovistas*.

During my investigation I found for the Netherlands 2 new *Lycoperdons*: *Lycoperdon umbrinum* Pers. and *Lycoperdon pyriforme* Pers. (this is not the species called by Oudemans *Lycoperdon piriforme* Rüpp.); 2 new *Bovistas*: *Bovista hungarica* Holl., *Bovista macrospora* Perdeck; and 1 *Bovistella*: *Bovistella radicata* (Dur. et Mont.) Pat. Together with *Disciseda*, there have now been found in the Netherlands 17 species of *Lycoperdaceae*, including 1 *Disciseda*, 3 *Calvatias*, 8 *Lycoperdons*, 1 *Bovistella*, 4 *Bovistas*. I have inserted some additional species, which may be expected to occur in the Netherlands.

### General morphology; terminology (fig. 1).

The general form of the *Lycoperdaceae* varies from globose to elongate with a more or less distinct stem and a more or less globose head. In most species this form is very variable. The diameter of adult specimens varies from less than 1 cm to 65 cm.

The outer layer of the fungus is called peridium. The outer part of the peridium, the exoperidium, consists of a more or less fugitive and loose structure of spines, warts, scales, fibrils or granules.



Sometimes it is more membranaceous (*Bovista*). The inner part of the peridium, the endoperidium, is more persistent and mostly smooth. It becomes visible in older specimens, when the exoperidium has fallen

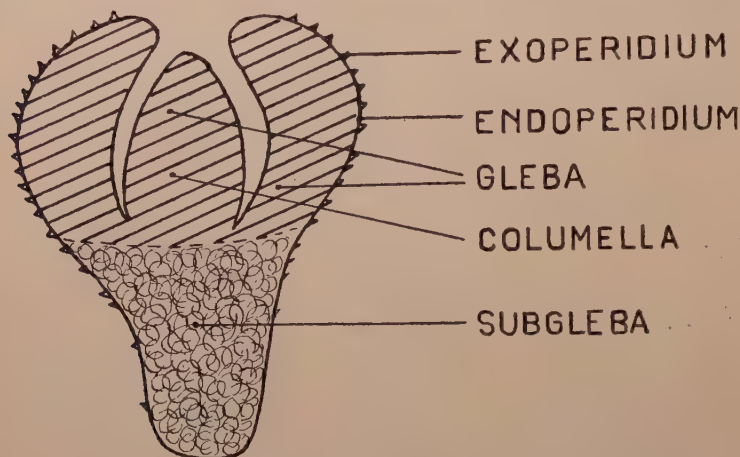


Fig. 1 — *Lycoperdon*, longitudinal section, scheme.

off. At maturity the peridium opens with a more or less definite, mostly apical, sometimes basal (*Disciseda*) pore, or the whole upper part of the peridium disappears (*Calvatia*). Transitions between these two extremes may be found (*Lycoperdon depressum*).

The peridium encloses the fertile portion, the gleba, and often a sterile portion below it, the subgleba. At maturity the gleba consists of a mass of spores and threads, the capillitium, and often shows in the centre of it a more or less definite part, the columella, which stands nearly free from the rest of the gleba, being attached to the subgleba. The subgleba may consist of small chambers, so-called cells, or of a compact, fibrillous mass. In the first case we speak of a cellular subgleba, in the second of a compact subgleba. The separation between gleba and subgleba may be more or less sharp. If the separation is sharp, we have to distinguish two cases. In the first case there is a distinct membrane between gleba and subgleba, the so-called diaphragm (*Lycoperdon depressum*). The cells of the subgleba lying under this diaphragm are then, in general, not smaller or more depressed than the more basal cells. In the other case there is no diaphragm, but the separation is due to the upper layer of cells, which become gradually more depressed towards the gleba, and are therefore not of the same size as the more basal ones (*Calvatia bovista*). It is not justified to speak of a well-defined diaphragm in this case as is done by Cunningham (see under *Calvatia bovista*).

The spores are mostly globose or subglobose, rarely ovoid or ellipsoid. They may be smooth or more or less warted. I call them strongly warted, if the warts are visible at the contour of the spore at a

magnification of  $450\times$  as a series of fine knots, smooth if no warts are visible at a magnification of  $1000\times$ , and finely warted when they show a constitution between these two extremes. I examined the spores in diluted alcohol. Always spores of ripe specimens (when these are "dusty") should be examined, since the warts in unripe spores are not yet fully developed. Sometimes the spores bear a remaining pedicel.

The threads of the capillitium show the main characters for distinguishing the genera. There are two main types of threads. First the threads of the Bovista-type, which are small units, each consisting of a short, thick main stem with a number of slender ramose branches soon tapering to a point (*Bovista*, *Bovistella*). The second type, the Lycoperdon-type, consists of threads without a distinct thick main stem (*Calvatia*, *Disciseda*, *Lycoperdon*); if there are main stems, they are very slender and merge into the side branches very gradually. These threads are sometimes much, sometimes little branched. They may break up into small pieces when maturing (*Disciseda*, *Calvatia bovista*). Sometimes they are hyaline and septate, but mostly coloured and not septate. About the structure of the capillitium see further: Hesse, Pringsheim's Jahrb., vol. 10, 1876, p. 383—398 and Tulasne, Ann. Sc. Nat., 2e ser., vol. 17, 1842, p. 5—18; the last-named author also gives very interesting particulars about the differences in the form of the basidia, etc. of several *Lycoperdon*-species.

### Abbreviations:

L or HLB = Herbarium Lugduno-Batavorum, the "Rijksherbarium" at Leiden.	
NBV = Herbarium of the "Koninklijke Nederlandse Botanische Vereniging" at Leiden.	
A = Herbarium of the University of Amsterdam.	
U = Herbarium of the University of Utrecht.	
GRO = Herbarium of the University of Groningen.	
Maastr. = Herbarium of the "Natuurhistorisch Museum" at Maastricht.	
Coll. Hoogland = Herbarium of Mr. R. Hoogland.	
Gr. = Province Groningen.	N.H. = Province Noord-Holland.
Fr. = " Friesland.	Z.H. = " Zuid-Holland.
Dr. = " Drente.	Zeel. = " Zeeland.
Ov. = " Overijsel.	N.B. = " Noord-Brabant.
Gld. = " Gelderland.	Limb. = " Limburg.
Utr. = " Utrecht.	

\* means: not yet found in the Netherlands.

### Key to the genera of Lycoperdaceae.

- 1a. Capillitium of short, slightly branched threads, furnished with short spines; peridium thick, mostly stellately opening with lobes; subgleba wanting  
6\*. *Mycenastrum*
- 1b. Threads of capillitium without spines.
- 2a. Capillitium of little units, each consisting of a thick, short main stem and slender ramose branches, with ends tapering to a point; spores (of the Netherlands species) with long persistent pedicels.
- 3a. Subgleba wanting; fungus soon loosening from the substratum; main stem of capillitium more than  $10\mu$  thick . . . . . 5. *Bovista*
- 3b. Subgleba present; fungus permanently attached to the substratum; main stem of capillitium less than  $10\mu$  thick . . . . . 4. *Bovistella*

- 2b. Threads of capillitium without a thick conspicuous main stem; spores (of the Netherlands species) without pedicels.
- 4a. Peridium, or at least the upper part of it, dehiscence as a whole; diaphragm and columella wanting . . . . . 2. *Calvatia*
- 4b. Peridium dehiscence by a more or less regular pore; sometimes this pore is very large, and in this case a diaphragm is present.
- 5a. Fungus soon loosening from the substratum; with a cup-shaped crust of soil adhering to remaining part of the exoperidium; capillitium threads soon breaking up into short pieces; subgleba wanting 1. *Disciseda*
- 5b. Fungus permanently attached to the substratum, without a cup-shaped crust of soil; capillitium not broken up into short pieces; subgleba mostly present . . . . . 3. *Lycoperdon*

### Key to the Netherlands species of Lycoperdaceae, neglecting the microscopical characters.

- 1a. Subgleba wanting, or, if present, compact, of the same structure as the gleba.
- 2a. Fungus 7—65 cm in diam., globose . . . . . *Calvatia gigantea*
- 2b. Smaller.
- 3a. With a more or less cup-shaped crust of adherent soil; fungus soon loosening from the substratum . . . . . *Disciseda bovista*
- 3b. Without such a crust.
- 4a. Fungus rooting, attached to the substratum; exoperidium consisting of furfuraceous spines or scales; subgleba sometimes present; gleba coherent . . . . . *Lycoperdon ericetorum*
- 4b. Fungus not rooting, soon loosening from the substratum; exoperidium membranaceous, nearly smooth, flaking off at maturity; subgleba always wanting; gleba incoherent, flocculose.
- 5a. Endoperidium at maturity brown-purplish, maculate; gleba at maturity purplish . . . . . *Bovista nigrescens*  
*Bovista hungarica*
- 5b. Endoperidium at maturity lead-coloured, or brownish, not maculate; gleba never purplish . . . . . *Bovista plumbea*  
 cf. also *Bovista macrospora*
- 1b. Subgleba present, cellular.
- 6a. Diaphragm present . . . . . *Lycoperdon depressum*
- 6b. Diaphragm wanting.
- 7a. At least the whole upper part of the peridium disappears at maturity.
- 8a. Stem mostly distinct; exoperidium consisting of fugacious small spines, scales or granules . . . . . *Calvatia excipuliformis*
- 8b. Stem rarely distinct; exoperidium consisting of a more or less dense, floccose, subpersistent coat, at last breaking up in scales.
- 9a. 5—10 cm high . . . . . *Calvatia bovista*
- 9b. 2—3½ cm high . . . . . *Bovistella radicata*
- 7b. Peridium at maturity opening with a more or less definite apical pore.
- 10a. Without distinct spines.
- 11a. Columella very distinct; mostly caespitose, on wood.  
*Lycoperdon piriforme*
- 11b. Columella not very distinct; not caespitose, on wood.
- 12a. Gleba coherent, often with an indistinct columella; exoperidium consisting of more or less fugacious small scales or granules.
- 13a. Gleba, when fully mature, purplish; its structure not clearly separated from that of the subgleba; mostly in woods . . . . . *Lycoperdon molle*
- 13b. Gleba never purplish; its structure more or less clearly separated from that of the subgleba; mostly in open places . . . . . *Lycoperdon spadiceum*
- 12b. Gleba incoherent, flocculose, without columella; exoperidium consisting of a more or less dense floccose subpersistent coat . . . . . *Bovistella radicata*



10b. With distinct spines.

14a. Spines not in small groups, exoperidium with a distinct reticulate structure . . . *Lycoperdon perlatum* var. *typicum*

14b. Spines in small groups, or, if not so, exoperidium without a distinct reticulate structure.

15a. Spines in small groups.

16a. Spines dark-brown

*Lycoperdon perlatum* var. *nigrescens*

16b. Spines of a brighter colour.

17a. Spines stout, groups of spines falling off in patches; gleba never purplish

*Lycoperdon candidum*

17b. Spines slender, not falling off in patches; gleba purplish, when wholly mature

*Lycoperdon molle*

15b. Spines not in groups.

18a. Spines stout, coarse

*Lycoperdon perlatum* var. *honordeni*

18b. Spines slender, fine, dark . *Lycoperdon umbrinum*

### 1. DISCISEDA Czern.

in Bull. Soc. Imp. Moscou vol. 18, 1845, p. 153 — *Catastoma* Morg. in J. Cincinn. Soc. Nat. Hist. vol. 14, 1892, p. 142.

Fungus growing just below the surface of the soil or partially exposed, subglobose; exoperidium impregnated with soil and at maturity breaking away circumscissilely, leaving the lower part in the soil, the apical part remaining as a kind of cupula; endoperidium opening by a basal pore; capillitium threads long, branched, breaking up into short pieces when mature.

### Key to the species.

1a. Spores 4—5  $\mu$  in diameter, minutely warted . . . . . 1\*. *D. candida*

1b. Spores 6—9  $\mu$  in diameter, strongly warted . . . . . 2. *D. bovista*

1\*. *Disciseda candida* (Schw.) Lloyd, Myc. Notes, vol. 1, 1902, p. 100; Cunningham in Proc. Linn. Soc. N. S. Wales, vol. 52, 1927, p. 238; Gaster. Austr., 1942, p. 137; Alexandri in Mem. Sect. Stiint. Acad. Rom., ser. 3, vol. 9, 1934, p. 46; Kambly and Lee in Univ. of Iowa Stud., vol. 17, 1936, p. 152; Bottomley in Bothalia, vol. 4, 1948, p. 570 — *Bovista candida* Schw., Syn. Fung. Carol., 1822, no. 333 — *Disciseda circumscissa* (Berk. et Curt.) Hollós in Termész. Fü., vol. 25, 1902, p. 102, 132; Gastr. Ung., 1904, p. 119; T. C. E. Fries in Ark.f. Bot., vol. 17, no. 9, 1921, p. 35.

Distribution: Europe (Sweden, Hungary, Czechoslovakia, Rumania), South Africa, America, Australia, Asia. Not yet found in the Netherlands.

2. *Disciseda bovista* (Klotzsch) Kambly in Kambly and Lee in Univ. of Iowa Stud., vol. 17, 1936, p. 153; van Eyndhoven in Meded. Ned. Myc. Ver., vol. 27, 1942, p. 3, 10 — *Geaster Bovista* Klotzsch in Nov. Act. Leop., vol. 19, suppl. 1, 1843, p. 243 — *Disciseda compacta* Czern. in Bull. Soc. Imp. Nat. Moscou, vol. 18, 1845, p. 153; T. C. E. Fries in Ark.f. Bot., vol. 17, no. 9, 1921, p. 35 — *Catastoma subterraneum* (Peck) Morg. in J. Cincinn. Soc. Nat. Hist., vol. 14, 1892, p. 143; Lloyd, Myc. Notes, vol. 1, 1903, p. 122; vol. 7, 1922, p. 1168 — *Disciseda debre-*

*ceniensis* (Hazsl.) Hollós in Termész. Füzet., vol. 25, 1902, p. 102, 132; Gastr. Ung., 1904, p. 119.

Description principally after Van Eyndhoven.

Fungus 10–35 mm in diam., globose or subglobose, developing hypogaeal, emerging at maturity and turning upside down; exoperidium, at least at maturity, consisting of 2 parts, the lower part being a thin membrane of grey to light brown colour, practically without debris, only with fine grains of sand sticking to it, at maturity loosening and remaining in the ground; the apical part consists of a similar membrane, but is covered with adherent soil, forming a persistent cup-shaped disk on the top of the fungus, visible as a small dark spot in the surface of the soil before emerging; endoperidium tough, solid, rather thick and hard, coriaceous to papyraceous, smooth, pale, whitish, grey, light brown or in older specimens plumbeous; pore not apical but basal, somewhat irregular, 4–10 mm in diam., flattened to mammose, often not well developed and not open; often there may be seen one or two additional irregular perforations; gleba umber-brown, powdery; spores 6–8  $\mu$  in diam.; globose, strongly verrucose; capillitium threads 3–4  $\mu$  thick, ramose, broken into pieces of varying length.

Habitat: on mossy places in the dunes, solitary or in small groups, October.

Specimens examined: Z.H.: Wassenaar (Meyendel) 1938, 1939, *Boetje-van Ruyven* (L); 1939, *Van Eyndhoven* (L); *de Lint* (L); (Raaphorst), 1949, *Perdeck* (L); (Voorlinden), 1948, *Maas Geesteranus* 4344 (L).

Distribution: Europe (Sweden, Netherlands, Germany, Hungary, Caucasus), S. Africa, Australia, America, Asia.

#### Remarks:

1. The first to use the combination *Disciseda bovista* was Kambly (l.c., 1936). Erroneously, van Eyndhoven attributed this combination to Hollós (l.c., 1942).

2. Cunningham (Proc. Linn. Soc. N.S.W., vol. 52, 1927, p. 238 and Gaster. Austr., 1942, p. 138) and Bottomley (Bothalia, vol. 4, 1948, p. 570) called the species *D. cervina* (Berk.) Holl. in Hedwigia vol. 42, 1903, p. (22). Van Eyndhoven l.c. showed that this was not correct.

## 2. CALVATIA Fr.

Summa Veg. Scand., vol. 2, 1849, p. 442; emend. Morgan in J. Cincinnati Soc. Nat. Hist., vol. 12, 1890, p. 165 — *Langermannia* Rostk. in Sturm, Deutschl. Fl. Abth. 3, fasc. 18, 1839, p. 3, 23.

Differs from *Lycoperdon* by the irregular dehiscence of at least the whole upper part of the peridium; columella and diaphragm wanting; in general large species.

#### Remarks:

1. The oldest valid name is *Langermannia* Rostk. 1839. Since this name has never been in general use, I propose to consider **Calvatia** a **nomen conservandum**.

2. The separation of this genus from *Lycoperdon* is not very satisfactory. *L. depressum* e.g. could be placed under either genus. Moreover

the difference between *Calvatia excipuliformis* and *Lycoperdon molle* is not very clear (see under these species).

### Key to the species of *Calvatia*.

- 1a. Subgleba wanting, or, if present, compact, not cellular of the same structure as the gleba; threads of capillitium septate.
  - 2a. Spores, when mature, smooth or minutely warted, warts not visible at an enlargement of  $450 \times$  . . . . . 1. *C. gigantea*
  - 2b. Spores, when mature, strongly warted, warts visible at an enlargement of  $450 \times$ .
    - 3a. Gleba soon turning purple . . . . . 2\*. *C. cyathiformis*
    - 3b. Gleba never purple . . . . . 3\*. *C. candida*
- 1b. Subgleba present, cellular; threads of capillitium not septate.
  - 4a. Spores, when mature, smooth or minutely warted, warts not visible at an enlargement of  $450 \times$ ; threads of capillitium mostly thicker than the spores, soon broken up into short pieces . . . . . 4. *C. bovista*
  - 4b. Spores, when mature, strongly warted, warts visible at an enlargement of  $450 \times$ ; threads of capillitium mostly thinner than the spores, not broken up into short pieces . . . . . 5. *C. excipuliformis*

1. *Calvatia gigantea* (Pers.) Lloyd, Myc. Notes, vol. 1, 1904, p. 166; ibidem, vol. 1, Lye. Austr., 1905, p. 36; T. C. E. Fries in Ark. f. Bot., vol. 17, no. 9, 1921, p. 21; Cunningham in Proc. Linn. Soc. N.S.W., vol. 51, 1926, p. 366; Bottomley in Bothalia, vol. 4, 1948, p. 573; Kambly and Lee in Univ. of Iowa Stud. vol. 17, 1936, p. 135 — *Lycoperdon giganteum* Pers., Syn. Fung., 1801, p. 140; in J. de Bot., vol. 2, 1809, p. 16; Peck in N. York State Mus. Nat. Hist., Rep. 32, 1879, p. 62; Oudemans in Arch. Néerl., vol. 15, 1880, p. 371 — *Bovista gigantea* (Pers.) Nees, Pilze, 1817, p. 34; Cool en v. d. Lek, Paddestoelenboek vol. 2, 1920, p. 233, 1935, p. 239, 1943, p. 255 — *Lycoperdon Bovista* Bull. ex Pers., Syn. Fung., 1801, p. 141, pro syn.; Vittadini, Mon. Lye., 1842, p. 37; in Mem. Real. Acc. Sc. Torino, ser. 2, vol. 5, 1843, p. 181; Westendorp in Prodr. Fl. Bat., vol. 2, pars 4, 1866, p. 14; Oudemans, Rév. Champ., 1892, p. 468; Cat. rais., 1904, p. 38 (non Pers., Syn. Fung. 1801, p. 141) — *Lycoperdon maximum* Schaeff. ex Pers., Syn. Fung., 1801, p. 140, pro syn. — *Calvatia maxima* (Schaeff. ex Pers.) Morg. in J. Cincinn. Soc. Nat. Hist., vol. 12, 1890, p. 166; Hollós, Gastr. Ung., 1904, p. 81; Alexandri in Mem. Sect. Stiint. Acad. Rom., ser. 3, vol. 9, 1934, p. 30.

Fungus 7—25 cm in diam., sometimes 65 cm (van Herweynen, Fungus, vol. 6, 1934, p. 29), subglobose; peridium white or yellowish, thick (to 3 mm), nearly smooth (exoperidium nearly absent), flaking off in irregular patches over the whole surface, when mature; gleba umber-brown when ripe, forming a more or less compact mass, which remains after the peridium has fallen off; subgleba scanty, compact, fibrillose, difficult to be distinguished from the gleba; spores 3,8—4,9  $\mu$  in diam., globose or subglobose, smooth or very finely warted; threads of capillitium up to 6,3  $\mu$  in diam., faintly coloured, septate, not very strongly ramose.

Habitat: grass-fields and manured grounds, gardens; mostly in groups, sometimes in large circles; from Aug. to Dec.

Specimens examined (from places with a literature reference, I have seen no material) Gld.: Bommelerwaard, 1899, *Flentge* (Lev. Natuur, vol. 4, 1899, p. 207); Malden, 1939, *Jansen* (L); Middachten, 1934, *Exc. N.N.V.* (Fungus, vol. 6, 1934, p. 38);



Nijmegen (*Oudemans*, l.c. 1892, p. 468); N.H.: Alkmaar, 1934, *Schweers* (Fungus, vol. 6, 1934, p. 52); Amsterdam, 1852, *van der Sande Laaste* (L); 1918, *van Flerken* (A); Haarlem?, *Greshoff* (L); Haarlem, 1914, *Cool* (L); Schagen, 1930, 1934, *van Herweynen* (Fungus, vol. 6, 1934, p. 29); Z.H.: 's-Gravenhage, 1948, *van Kregten* (L); Koudekerk, 1948, *Laman* (L); Koudekerk, 1948, *Fierêt* (L); Leiden, 1911, *van der Lck* (L); Oude Wetering, 1948, *Smits* (L); Vennemeer, 1943, *Maas Geesteranus* (L); Westland (*Oudemans*, l.c., 1892, p. 468); N.B.: 's Hertogenbosch (*Oudemans*, l.c. 1892, p. 468); Limb.: Gennep, 1948, *Schweers* (L); Maastricht, 1943, *Etc. Nat. Hist. Gen.* (Nat. Hist. Maandbl., vol. 33, 1943, p. 90).

**Distribution:** Europe (Sweden, Denmark, England, Netherlands, Belgium, Germany, Austria, France, Switzerland, Czechoslovakia, Rumania, Hungary, Jugoslavia, Bulgaria, Italy), S. Africa, N. America, Asia.

**Remarks:**

1. Persoon left no material of the present species, but there can be no misunderstanding about what he meant.

2. The first to use the combination *Calvatia gigantea* was Lloyd (1904). This combination was found independently by T. C. E. Fries (1921) and by Cunningham (1926).

2\*. *Calvatia cyathiformis* (Bosc) Morg. in J. Cincinn. Soc. Nat. Hist., vol. 12, 1890, p. 168; Hollós, *Gastr. Ung.*, 1904, p. 84; Kambly and Lee in Univ. of Iowa Stud. vol. 17, 1936, p. 137 — *Lycoperdon cyathiforme* Bosc in Ges. Nat. Freunde Berlin Mag., vol. 5, 1811, p. 87 — *Lycoperdon fragile* Vitt., *Mon. Lyc.*, 1842, p. 36; in Mem. Real. Acc. Sc. Torino, ser. 2, vol. 5, 1843, p. 180; Petri, *Fl. Ital. Crypt.*, pars 1, fasc. 5, 1909, p. 55 — *Bovista lilacina* Mont. et Berk. in Hooker, *Lond. J. of Bot.*, vol. 4, 1845, p. 64 — *Calvatia fragilis* (Vitt.) Morg., in J. Cincinn. Soc. Nat. Hist., vol. 12, 1890, p. 168 — *Calvatia lilacina* (Mont. et Berk.) Lloyd, *Myc. Notes*, vol. 1, *Lyc. Austr.*, 1905, p. 35; Cunningham, in J. Linn. Proc. Soc. N. S. Wales, vol. 51, 1926, p. 365; *Gaster. Austr.*, 1942, p. 157; Stevenson and Cash, *Bull. Lloyd Libr.*, vol. 35, 1936, p. 172; Bottomley in *Bothalia*, vol. 4, 1948, p. 572.

**Distribution:** Europe (Germany, Austria, Russia, Hungary, France, Portugal, Italy, Greece), Africa, America, Asia. Not yet found in the Netherlands.

3\*. *Calvatia candida* (Rostk.) Holl. in *Termész. Füz.*, vol. 25, 1902, p. 112, 137; *Gastr. Ung.*, 1904, p. 89; Cunningham in J. Proc. Linn. Soc. N. S. Wales, vol. 51, 1926, p. 367; *Gaster. Austr.*, 1942, p. 158; Alexandri in Mem. Sect. Stiint. Acad. Rom., ser. 3, vol. 9, 1934, p. 34; Bottomley in *Bothalia*, vol. 4, 1948, p. 575 — *Langermannia candida* Rostk., in Sturm, *Deutschl. Fl.*, vol. 3, fasc. 18, 1839, p. 25.

**Distribution:** Europe (France, Germany, Hungary, Italy), S. Africa, Australia. Not yet found in the Netherlands.

4. *Calvatia bovista* (Pers.) Th. Fr. Jr. in *Ark. f. Bot.*, vol. 17, no. 9, 1921, p. 21; Kambly and Lee in Univ. of Iowa Stud., vol. 17, 1936, p. 138 — *Lycoperdon Bovista* Pers., *Syn. Fung.*, 1801, p. 141, in J. de Bot., vol. 2, 1809, p. 16 (non Bull. ex Pers., *Syn. Fung.*, 1801, p. 141, pro syn.) — *Lycoperdon caelatum* Bull. ex Pers., *Syn. Fung.*, 1801, p. 141, pro syn.; Vitt., *Mon. Lyc.*, 1842, p. 44; in Mem. Real. Acc. Sc. Torino, ser. 2, vol. 5, 1843, p. 188; Westendorp in *Prodr. Fl. Bat.*, vol. 1, pars 4, 1866, p. 14, p.p.; Oudemans in *Arch. Néerl.*, vol. 15, 1880, p. 370; *Rév. Champ.*, 1892,

p. 468; Cat. rais., 1904, p. 38 — *Bovista officinarum* Rostk. in Sturm, Deutschl. Fl., vol. 3, fasc. 18, 1839, p. 5 — *Bovista suberosa* Rostk., l. c. p. 7 (non Fr.) — *Calvatia caelata* (Bull. ex Pers.) Morg., in J. Cincinn. Soc. Nat. Hist., vol. 12, 1890, p. 169; Hollós, Gastr. Ung., 1904, p. 83; Lloyd, Myc. Notes, vol. 1, 1904, p. 166, Lye. Austr., 1905, p. 35; Cunningham in Proc. Linn. Soc. N. S. Wales, vol. 51, 1926, p. 365; Gaster. Austr., 1942, p. 156; Alexandri in Mem. Seet. Stiint. Acad. Rom., ser. 3, vol. 9, 1934, p. 31; Bottomley in Bothalia, vol. 4, 1948, p. 572 — *Calvatia favosa* (Rostk.) Lloyd, Myc. Notes, vol. 1, Lye. Austr., 1905, p. 36 — *Calvatia Fontanesii* (Dur. et Mont.) Lloyd, l. c. p. 36.

Fungus 4—10.5 cm high, 3.5—10.5 cm wide, mostly about as high as wide, mostly depressed at the upper side, narrowing gradually into the base; stem mostly not very distinct; exoperidium consisting of a fairly dense layer of white, grey or brown hairy fibres, which either form an even velvety layer, or stand in little groups. These groups give rise to either spinulose flocks, or to definite spinulose scales, which form a more or less areolated structure; these structures are pretty persistent and disappear only by old specimens; endoperidium light brown, glossy, dehiscing irregularly at the upper side, after which the gleba falls out and so only the subgleba, with a low, upright, mostly fairly regular lobed collar, remains; gleba when mature olive- or umber-brown, without columella, little coherent, easily loosening from the subgleba; subgleba occupying about  $\frac{1}{2}$  of the total height, sharply separated from the gleba, but without diaphragm, minutely cellular, yellowish to purplish-brown; root often strongly developed; spores 3.4—4.5  $\mu$  in diam., globose or subglobose, smooth; threads of capillitium up to 7.0  $\mu$  thick, mostly thicker than the spores, pale coloured, not septate, more or less branched, soon breaking up into small fragments, slack — *fig. 2*.

**Habitat:** grassfields, dunes, often in deciduous woods, July to Nov. (March, April, May).

**Specimens examined:** Gld.: Brummen, 1863, *Oudemans* (GRO); Epe, 1948, *Kleyn* (L); Nijmegen, *Abeleven* (L); Osseveld, 1894, *Kok Ankersmit* (L); Ruurlo, 1948, *Agsteribbe* (L); Wilp, 1947, 1948, *van Heurn* (L); N. H.: Amsterdamse Bos, 1948, *Schutte* (L); Ankeveen, 1916, *van Overeem* (A); Bergen, 1914, *van Overeem* (A); Castricum, 1914, *van Overeem* (A); Haarlem, 1918, *Ned. Myc. Ver.* (A); Heemstede, 1862, *Hartsen* (GRO); Vlieland, 1949, *van Heurn* (L); Z. H.: 's-Gravenhage, *Perdeck* 162 (L); Leiden, 1846, *Oudemans* (GRO); Oostvoorne (Kwakjeswater), 1915, *Goethart* (L); Oud Ade, 1948, *Maas Geesteranus* 4281 (L); Scheveningen, 1948, *Zaneveld* (L); Wassenaar (Meiendel), 1927, *Schure* (L); 1948, 1949, *Perdeck* 163, 200 (L); *Molkenboer* (L); Zeel.: Z. Beveland, *van den Bosch* (L); Zwake, 1844, *van den Bosch* (L); Limb.: Gennep, 1948, *Schweers* (L).

**Distribution:** Europe (Sweden, Denmark, England, Netherlands, France, Germany, Switzerland, Austria, Czechoslovakia, Hungary, Rumania, Russia, Italy), Africa, Australia, N. America, Asia.

#### Remarks:

1. According to Cunningham (l. c.) and Bottomley (l. c.) this species has a well defined diaphragm. Neither the specimens found in the Netherlands, nor the type in Persoon's herbarium show any trace of it. I suspect these authors did not notice the difference between a mere sharp separation between gleba and subgleba and the presence of a diaphragm (see p. 482).

2. In Persoon's herbarium three *Calvatia*-specimens may be found to which Persoon has added the name *Lycoperdon Bovista*. One of these (no. HLB 910. 258—454) is *Calvatia cyathiformis* (Bose) Morg. The two others are the species in question. I consider no. HLB 910. 258—460 as the type specimen, for Persoon wrote under the name: "Syn. fung.", and so referred to his original description of this species.

3. T. C. E. Fries (l.c. 1921) was the first to make the combination *Calvatia bovista* and not Kambly and Lee (l.c. 1936), as they believed.

5. *Calvatia excipuliformis* (Pers.) Perdeck, nov. comb. — *Lycoperdon excipuliforme* Pers., Syn. Fung. 1801, p. 143; in J. de Bot., vol. 2, 1809, p. 21 (non Scop.) — *Lycoperdon macrorrhizon* Pers. in J. de Bot., vol. 2, 1809, p. 22 — *Lycoperdon saccatum* Fr., Syst. Myc., vol. 3, 1829, p. 35; Westendorp in Prodr. Fl. Bat., vol. 2, pars 4, 1866, p. 13; Oudemans in Arch. Néerl., vol. 15, 1880, p. 371; Rév. Champ., 1892, p. 467; Cat. rais., 1904, p. 40; Petri, Fl. Ital. Crypt., pars 1, fasc. 5, 1909, p. 53 (non Pers. in J. de Bot., vol. 2, 1809, p. 19) — *Calvatia saccata* (Fr.) Morg. in J. Cincinn. Soc. Nat. Hist., vol. 12, 1890, p. 171; Lloyd, Myc. Notes, vol. 1, 1904, p. 166; Hollós, Gastr. Ung., 1904, p. 86; T. C. E. Fries in Ark. f. Bot., vol. 17, no. 9, 1921, p. 22; Nüesch in Ber. Schweiz. Bot. Ges., vol. 43, 1934, p. 133; Alexandri in Mem. Sect. Stiint. Acad. Rom., ser. 3, vol. 9, 1934, p. 32; Kambly and Lee in Univ. of Iowa Stud., vol. 17, 1936, p. 137; Bottomley in Bothalia, vol. 4, 1948, p. 574 — *Lycoperdon favosum* Oudemans in Ned. Kruidk. Arch., ser. 3, vol. 2, 1902, p. 676 (non (Rostk.) Bon.).

Fungus 6—11 cm high, 3.5—6 cm wide, height-width ratio from  $\frac{3}{1}$  till  $\frac{1}{1}$ , mostly with a distinct stem, which is longer than the head; stem often somewhat bulbous; sometimes without a distinct stem and then resembling *C. bovista*; transition from stem into head mostly plicate; exoperidium mostly consisting of very fine, stellately placed, small spines, which sometimes have a more granulose or scaly appearance, fugacious; endoperidium olive to umber-brown; soft and thin, especially at the top, at maturity irregularly dehiscent and finally entirely disappearing, so that only the stem remains; gleba olive- to umber-brown; subgleba not sharply separated from the gleba, occupying  $\frac{2}{3}$  to  $\frac{3}{4}$  of the total height, cellular, olive- or umber-brown, often somewhat purplish; spores (4,2)4,9—5,6(6,3)  $\mu$  in diam., globose, strongly warted when wholly mature, often mixed with fallen pedicels; threads of capillitium up to 4,2(5,6; 11,2)  $\mu$  thick, thinner than the spores, not very strongly ramose — fig. 3, 4.

Habitat: especially in deciduous woods, solitary or in groups, from July to Nov. (March, April).

Specimens examined: Gld.: Epe, 1948, van Kregten (L); Lage Vuursche, 1948, Kleijn (L); Ruurlo, Agsteribbe, 1948 (L); Weurt, 1848, Abeleven (NBV); Wilp, 1948, van Heurn (L); Utr.: Amersfoort, 1917, van Overeem a.o. (A); Driebergen (L); N. H.: Bloemendaal, 1915, Boedijn (A); Bussum, 1916, van Overeem a.o. (A); Haarlem, 1915, Cool (L); Hilversum (Spand. Woud), 1915, de Mol (A); Muiden, 1915 (A); Vogelenzang, 1874, de Vries and Moll (GRO); Z. H.: Kijkduin, de Lint (L); Leiden, Molkenboer (L); 1847, Oudemans (GRO); Lisse, 1915, van Overeem a.o. (A); Oegstgeest, 1948, Maas Geesteranus 4334 (L); Wassenaar, Timmermans (L); (Raaphorst), 1933, Goddijn and Lütjeharms (L), 1949, Barkman (L); (Meyendel), 1949, Perdeck 201 (L); Zeel.: Zwake, 1844, van den Bosch (L); N. B.: Eindhoven, 1948, Daams (L); Oosterhout, 1948, van Alphen (L); Limb.: Valkenburg, 1900, Rück (GRO).

Distribution: Europe (Sweden, Denmark, England, Netherlands,



Belgium, France, Germany, Austria, Czechoslovakia, Hungary, Rumania, Italy), S. Africa, N. America.

Remarks:

1. This species is sometimes difficult to distinguish from *Lycoperdon molle* Pers., especially young specimens, without a pore and without a distinct stem. *Calvatia excipuliformis*, however, has never a columella nor a purple gleba.

2. Hollós (l.c.) and Nüesch (l.c.) distinguish several varieties but the Netherlands specimens do not allow me to have an opinion about them.

3. The name *Calvatia saccata* (Vahl) Morg., as the species mostly has been called up to this time is not valid. Vahl (Fl. Dan., vol. 7, fasc. 19, 1794, p. 8, tab. 1139) gives no name, neither with his plate, nor in the text; he only cites some phrase-names, one of which begins with: "Lycoperdon saccatum, cinereum polline obscure viridi.....". Persoon was the first to use the name *Lycoperdon saccatum* (J. de Bot., vol. 2, 1809, p. 19) but in another sense, as appears from the type in his herbarium (no. HLB 910. 258—641). This specimen is a form of *Lycoperdon pyriforme* Pers. So the name *L. saccatum*, used by Fries (l.c. 1928) for the species in question is not valid being a later homonym.

4. Persoon (l.c. 1801) called the species *Lycoperdon excipuliforme*. The specimens in his herbarium to be found under this name (no. HLB 910. 258—511 and 910. 258—510) leave no doubt in this respect (Lloyd had already mentioned this on a label when he studied the herbarium Persoon). Therefore the valid name is *Calvatia excipuliformis*.

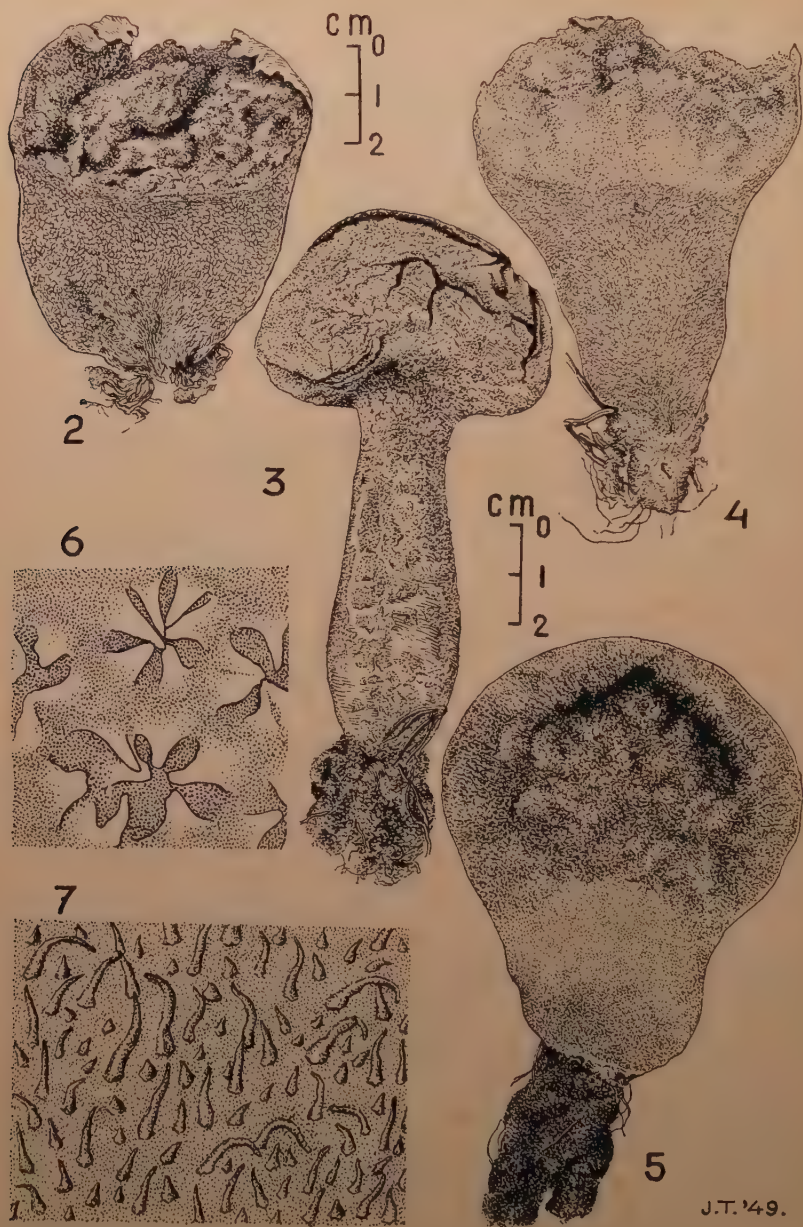
5. This *Lycoperdon excipuliforme* of Persoon is surely not the *L. excipuliforme* of Scopoli (Fl. Carniolica, 2e ed., 1772, p. 488), by which species very probably was meant *Lycoperdon perlatum* Pers., as among others appears from the quotation of tab. 12, fig. 15 of Vaillant's *Botanicon Parisiense* (1727).

Probably the same holds for the species which was called *L. excipuliforme* by Hollós (l.c. 1904, p. 103), Morgan (l.c. 1890, p. 14) and Vittadini (l.c. 1843, p. 193) (cf. Lloyd, Myc. Notes, vol. 1, 1904, p. 168, 187; vol. 2, 1906, p. 265).

6. The specimens of *L. macrorhizon* Pers. in the herbarium of Persoon (no. HLB 910. 258—469) show this species to be identical with *Calvatia excipuliformis*. Lloyd already noticed this, as appears from a label written by him. The spores are not wholly ripe, so most of them are not strongly warted. The specimens in the herbarium are the same from which are drawn the figures in J. de Bot.

7. According to Hollós (l.c. p. 164) *Lycoperdon boletoides* Pers. (l.c. 1809, p. 22) is a synonym of the species concerned. In the herbarium of Persoon no material of this species could be found so that this statement could not be checked.

8. Oudemans (l.c., 1902) described a new species: *Lycoperdon favosum*. In the first place this name cannot be used, for it is already known as a synonym of *Calvatia bovista*, viz. *Lycoperdon favosum* (Rostk.) Bon. in Bot. Zeit., vol. 15, 1857, p. 595. Further, the only specimen, which was found by Rick at Valkenburg in 1900 could not be retraced in any of the existing herbaria. Judging from the description and the plate it is a



J.T. '49.

Fig. 2 — *Calvatia bovista* (Pers.) Th. Fr. Jr., longitudinal section; 3 — *C. excipuliformis* (Pers.) Perdeck; 4 — *C. excipuliformis* (Pers.) Perdeck, longitudinal section, nat. size; 5 — *Lycoperdon ericetorum* Pers., large specimen, longitudinal section, nat. size; 6 — *L. candidum* Pers., structure of exoperidium, enlarged; 7 — *L. umbrinum* Pers., structure of exoperidium, enlarged.

*Calvatia excipuliformis*, which differs only by the indented stem, with some big spines in each dent.

### 3. LYCOPERDON Pers. emend. Rostk.

in Sturm, Deutschl. Fl., vol. 3, fasc. 18, 1839, p. 2.

Fungus with a more or less distinct stem or sessile, permanently attached to the substratum; exoperidium usually consisting of spines, warts, scales or granules, more or less fugacious; endoperidium persistent, opening by a definite apical pore; columella often present; subgleba mostly present, cellular or compact; spores globose or rarely ellipsoid, smooth or warted; threads of capillitium without a distinct main stem, more or less branched, sometimes septate.

#### Remarks:

1. The first to use the name *Lycoperdon* in this restricted sense (excluding the species now placed under *Calvatia*) was Rostkovius and not Morgan, as is generally assumed.

2. In the author's opinion it would be preferable to exclude *Lycoperdon depressum* Bon., with its mostly very large pore, and to put it in a new genus characterized by the possession of a diaphragm and the hyaline, septate threads of capillitium.

#### Key to the species of Lycoperdon.

- 1a. Subgleba wanting or, if present, compact, not cellular, of the same structure as the gleba.
  - 2a. Spores with permanent pedicels; very small species, about 0.5—1.0  $\mu$  in diam. . . . . 1\*. *L. echinellum*
  - 2b. Spores without permanent pedicels; larger species . . . . . 2. *L. ericetorum*
- 1b. Subgleba present, cellular.
  - 3a. Spores with permanent pedicels . . . . . 3\*. *L. pedicellatum*
  - 3b. Spores without permanent pedicels.
    - 4a. Diaphragm present; capillitium threads hyaline, septate 4. *L. depressum*
    - 4b. Diaphragm wanting; most of the capillitium threads coloured, not septate.
      - 5a. Spores, when mature, strongly warted, the warts (at an enlargement of 450  $\times$ ) visible along the contour of the spore as a series of fine knots; spores mostly more than 4.5  $\mu$  in diam.; gleba mostly purplish when ripe.
        - 6a. Exoperidium with dark, 3—4 mm long spines, leaving a reticulate structure, when they have fallen off . . . . . 5\*. *L. echinatum*
        - 6b. Exoperidium without such long spines, not leaving a reticulate structure . . . . . 6. *L. molle*
      - 5b. Spores, when mature, smooth or minutely warted, warts not distinctly visible at an enlargement of 450  $\times$ ; spores mostly less than 4.5  $\mu$  in diam.; gleba never purplish when ripe.
        - 7a. Exoperidium with distinct spines.
          - 8a. Exoperidium with white stout convergent spines falling off in plates or patches; gleba and subgleba distinctly separated . . . . . 7. *L. candidum*
          - 8b. Exoperidium without such spines falling off in patches.
            - 9a. Spines not fine and slender, or, if so, arranged in small groups and convergent or, after having fallen off, leaving light coloured areoles which form a more or less distinct reticulate structure; columella distinct 9. *L. perlatum* <sup>1)</sup>

<sup>1)</sup> *L. pyriforme* rarely has distinct spines and in this case it is very difficult to distinguish it from *L. perlatum*.



- 9b. Spines very fine and slender, dark, crowded, never regularly arranged in groups, reticulated structure always wanting . . . . . 8. *L. umbrinum*
- 7b. Exoperidium without distinct spines.
- 10a. Columella very distinct; subgleba white to pale brown, when mature always of a paler colour than the gleba; caespitose, mostly lignicolous . . . . . 10. *L. pyriforme*
- 10b. Columella indistinct; subgleba dark brown or purplish when mature, never of a paler colour than the gleba; not caespitose, terrestrial . . . . . 11. *L. spadiceum*

1\*. *Lycoperdon echinellum* (Pat.) Perdeck, nov. comb. — *Bovista echinella* Patouillard in Bull. Soc. Myc. France, vol. 7, 1891, p. 165; Lohwag in Beih. Bot. Centralbl., vol. 51, 1933, p. 269 — *Bovistella echinella* (Pat.) Lloyd, Myc. Notes, vol. 2, 1906, p. 262, 286; vol. 3, 1910, p. 452; vol. 5, 1910, p. 602; T. C. E. Fries in Ark. f. Bot., vol. 17, no. 9, 1921, p. 31.

Distribution: Europe (Sweden, Denmark, Lapland, Austria), N. and S. America. Not yet found in the Netherlands.

Remark: This species has a capillitium of the *Lycoperdon*-type, for which reason it is placed in this genus.

2. *Lycoperdon ericetorum* Pers. in J. de Bot., vol. 2, 1809, p. 17, tab. 2, fig. 1a and b; Hollós, Gastr. Ung., 1904, p. 168, pro syn. — *Lycoperdon furfuraceum* Schaeff. ex Vitt. in Mem. Real. Acc. Sc. Torino, ser. 2, vol. 5, 1843, p. 183, pro syn.; de Toni, in Sacc., Syll. Fung. vol. 7, 1888, p. 110; Hollós, Gastr. Ung., 1904, p. 105; Alexandri in Mem. Sect. Stiint. Acad. Rom., ser. 3, vol. 9, 1932, p. 75 — *Lycoperdon cepaeforme* Bull. ex Pers. in J. de Bot., vol. 2, 1809, p. 17, pro syn.; Morgan, in J. Cincinn. Soc. Nat. Hist., vol. 14, 1891, p. 20 — *Lycoperdon polymorphum* Vitt., Mon. Lye., 1842, p. 39; in Mem. Real. Acc. Sc. Torino, ser. 2, vol. 5, 1843, p. 183; Lloyd, Myc. Notes, vol. 1, no. 16, 1904, p. 167; Myc. Notes, vol. 2, no. 19, 1905, p. 215; Petri, Fl. Ital. Crypt., pars 1, fasc. 5, 1909, p. 47; T. C. E. Fries in Ark. f. Bot., vol. 17, no. 9, 1921, p. 29; Cunningham in Proc. Linn. Soc. N. S. Wales, vol. 51, 1926, p. 635; Gaster. Austr., 1942, p. 151 — *Lycoperdon pusillum* Pers. in J. de Bot., vol. 2, 1809, p. 17; Fries, Syst. Myc., vol. 3, 1829, p. 33; Hollós, Gastr. Ung., 1904, p. 107; Lloyd, Myc. Notes, vol. 1, no. 16, 1904, p. 167; Myc. Notes, vol. 2, no. 19, 1905, p. 216; Petri, Fl. Ital. Crypt., pars 1, fasc. 5, 1909, p. 48; T. C. E. Fries in Ark. f. Bot., vol. 17, no. 9, 1921, p. 29; Cunningham in Proc. Linn. Soc. N. S. Wales, vol. 51, 1926, p. 636; Gaster. Austr., 1942, p. 152; Alexandri in Mem. Sect. Stiint. Acad. Rom., ser. 3, vol. 9, 1932, p. 76 — *Lycoperdon dermoxanthum* Vitt. Mon. Lye., 1842, p. 34; in Mem. Real. Acc. Sc. Torino, ser. 2, vol. 5, 1843, p. 178.

Fungus 0.8–3.5 (6) cm high, 0.7–3 (5) cm wide; height-width ratio mostly  $\frac{1}{1}$ , sometimes up to  $\frac{1}{2}$ ; very variable; globose or more depressed, sessile or pear-shaped with a more or less distinct stem; exoperidium when immature white, yellowish or grey, turning darker when mature, consisting of a coat, which is divided in small fields by little cracks, or of granules, small scales or very fine short small spines; in old specimens these structures may have colours varying from white to almost black and are fairly persistent; endoperidium bright to dark brown, often reddish at the base, typically papery cracking when mature; pore 2–8 mm in diam., often

mammose; gleba olive- or umber-brown, when mature, rarely with a faint columella; subgleba often absent; when present gradually passing over into the gleba, occupying up to  $\frac{1}{2}$  of the total height; structure very much the same as in the gleba, not cellular, fibrillous, white, yellowish or umber-brown; roots fairly strongly developed; spores globose and (3,1) 3,8—4,5 (5,2)  $\mu$  in diam. or broadly ellipsoid, 4,5—5,2  $\mu$  long and 3,5—4,2  $\mu$  wide, smooth or finely verrucose; threads of capillitium to 6,3 (9,8; 14,0)  $\mu$  thick, coloured, strongly ramose — *fig. 5*.

**Habitat:** in open fields or in woods (both coniferous and deciduous woods), specially on sand, mostly on dry, but also on moist ground; growing mostly in small groups or clusters, from July to Nov. (Dec., Febr.).

**Remarks:**

1. Most authors consider specimens without a subgleba to be a distinct species, *Lycoperdon pusillum* Pers. I cannot agree with this, for Persoon (1809) distinguishes *L. pusillum* only by its small size. However I found all transitions between big and small specimens, even growing on the same spot. Most of the later authors (of whom Vittadini, 1842, was the first) give the absence of the subgleba as a decisive character of *L. pusillum*. Concerning this character, too, I found all stages between the absence and the strong development of the subgleba in specimens of one locality; moreover Persoon's herbarium contains specimens, named *L. ericetorum*, with and without a subgleba. The microscopical differences between *L. pusillum* and *L. ericetorum*, given by Petri (1909) could not be confirmed.

2. Persoon's description, plate and herbarium specimens show that he meant with his *L. ericetorum* only the sessile, subglobose specimens. Vittadini (1842) had already proved that pear-shaped somewhat stemmed specimens\* belong also to this species.

3. The valid name of this species is *L. ericetorum* Pers. (1809) which is proved by the very good specimens in Persoon's herbarium (no. HLB 910. 258—491; HLB 910. 258—502; HLB 910. 258—514). In his collection there is also a specimen (no. HLB. 910. 258—470) with a more or less distinct stem under the name *L. molle*. It is clear that Persoon was here mistaken (cf. remark 2 and p. 500).

4. With regard to the much used name *L. furfuraceum*, it is possible that Persoon with his *Bovista? furfuracea* (Syn. Fung., 1801, p. 138) meant what he later called *L. ericetorum*. But there is so little evidence for this viewpoint that I think it would be better not to use the name *L. furfuraceum* (which is cited by Persoon as a synonym of this *Bovista? furfuracea*). The same holds for his *Bovista pusilla*, l.c. and his later *L. pusillum*.

5. The name *L. cepaeforme* of Bulliard (Hist. Champ. vol. 1, 1791, p. 148) must be rejected, for Persoon gives it as a synonym of his *L. pratense* (Syn. Fung. 1801, p. 142) and afterwards (1809) as a synonym of *L. ericetorum* (l.c. 1809).

6. *L. dermozanthum* Vitt., which is a synonym of *L. pusillum* according to Lloyd, who saw the type-specimen (Myc. Notes, vol. 7, 1923, p. 1222), must now be considered as a synonym of *L. ericetorum*, just as is true of the name *L. polymorphum* under which Vittadini has given a very good description of the species in question.

7. The specimens called *L. pusillum* Batsch by Westendorp (Prod. Fl. Bat., vol. 2, pars 4, 1866, p. 14) appeared to be *L. ericetorum* Pers. The specimens called *L. aestivale* Bon. by Oudemans (Arch. Néerl., vol. 8, 1873, p. 253; vol. 15, 1880, p. 372) and *L. vittadinii* Mass. (Rév. Champ., 1892, p. 468; Cat. rais., 1904, p. 40) are also *L. ericetorum* Pers. The same holds for one specimen, called by Oudemans *L. serotinum* Bon. (l. c. 1873, p. 23, l. c. 1880, p. 373), but I could not decide this regarding the specimen cited under this name by him in Ned. Kruid. Arch., ser. 3, vol. 2, 1903, p. 200 and by C. Destrée in Handl. Hogere Zwammen, 1901, p. 299, for it has apparently disappeared.

### Key to the varieties.

- 1a. Spores globose . . . . . var. **typicum**  
 1b. Spores broadly ellipsoid . . . . . var. **oblongisporum**

***Lycoperdon ericetorum* Pers. var. *typicum*** — for synonyms see above.

Spores globose, (3,1) 3,8—4,5 (5,2)  $\mu$  in diam.

Specimens examined: Gld.: Nunspeet, 1900, *Beins* (GRO); Nijmegen, 1948, *Schweers* (L); Wilp, 1949, *van Heurn* (L); Utr.: Doorn, 1869, *Oudemans* (L, GRO, U); Lage Vuursche, 1948, *Kleijn* (L); Zeist, 1884, *Oudemans* (L); N. H.: Amsterdam (A'damse bos), 1948, *Agsteribbe* (L); Bloemendaal, 1915 (L); Bussum, 1916, 1917, *van Overeem a.o.* (A); Castricum, 1914, *van Overeem* (A); Haarlem, *Splitgerber* (L); 1916, *Cool* (L); Leyduin, 1916, *van Overeem a.o.* (A); Vogelenzang, 1914, *Cool* (L); Z. H.: Dordrecht, 1949, *Kinstra* (L); Katwijk, 1845, *Perin* (L); Leiden, 1835, *Arcenhausen* (L); Molkenboer (L); Noordwijk, 1948, *van Ooststroom* 11039 up to 11042 incl. (L); Wassenaar, 1865, *Perin* (L); (Duinrell), 1945, *exc. N. N. V.* (L); 1948, *Fervoort* (L); 1948, *van Ooststroom* 11057 (L); 1948, *Perdeck* 152 up to 154 incl., 183 up to 185 incl. (L); (Meyendel), 1926, *Hoogland*, P. J. (L); (Rust en Vreugd), 1949, *van Ooststroom* 12428 (L); (Voorlinden), 1948, *Maas Geesteranus* 4339, 4340, 4342 (L); 1948 *Perdeck* 190, 191 (L); N. B.: Bergen op Zoom, 1901, *La Fontijn* (GRO); Breda, 1865, *Nagelvoort* (GRO); Drimmelen, 1949, *Kenniphaas* (L); Zeel.: Renesse, 1949, *Hoogland*, R., 2000 (coll. Hoogland).

Distribution: Europe (Sweden, England, Netherlands, Belgium, France, Germany, Austria, Czechoslovakia, Hungary, Rumania, Portugal, Italy), S. Africa, N. America, Australia.

***Lycoperdon ericetorum* Pers. var. *oblongisporum* (B. et C.) Perdeck nov. comb.** — *Lycoperdon oblongisporum* B. et C. in J. Linn. Soc., vol. 10, 1867, p. 345; Massee in J. Roy. Micr. Soc., 1887, p. 723; Morgan, in J. Cincinn. Soc. Nat. Hist., vol. 14, 1891, p. 19; Hollós, Gastr. Ung., 1904, p. 115; Lloyd, Myc. Notes, vol. 2, 1905, p. 235; Kambly and Lee in Univ. of Iowa Stud., vol. 17, 1936, p. 148.

Spores broadly ellipsoid, 4,5—5,2  $\mu$  long, 3,5—4,2  $\mu$  wide.

Specimens examined: Z. H.: Wassenaar (Duinrell), 1948, *Perdeck* 182 (L).

Distribution: Europe (Netherlands, Hungary), America.

### Remarks:

1. Differs from var. *typicum* only by the ellipsoid spores. Therefore I consider it as a variety of *L. ericetorum*.

2. Bottomley (in Bothalia, vol. 4, 1948, p. 558) states that the specimens of *L. ericetorum* (called by him *L. polymorphum*) found in S. Africa are mostly subglobose to broadly oval. In my opinion these specimens also belong to this variety.

3\*. ***Lycoperdon pedicellatum* Peck.** in N.-York State Mus. Rep. 26, 1874, p. 73; l. c. 32, 1879, p. 68; Hollós, Gastr. Ung., 1904, p. 114; Killer-



mann, Krypt. Forsch., vol. 1, 1926, p. 507; Schwarz in Am. J. Bot. vol. 23, 1936, p. 4; Kambly and Lee in Univ. of Iowa Stud., vol. 17, 1936, p. 144 — *Lycoperdon caudatum* Schroeter in Cohn, Krypt. Fl. Schles. vol. 31, 1889, p. 698 — *Bovistella pedicellata* (Peck) Lloyd, Myc. Notes, vol. 2, 1906, p. 262, 282; T. C. E. Fries in Ark. f. Bot., vol. 17, no. 9, 1921, p. 30.

Distribution: Europe (Sweden, Germany, Hungary), N. America. Not known from the Netherlands.

4. *Lycoperdon depressum* Bon. in Bot. Zeit., vol. 15, 1857, p. 611; Oudemans in Arch. Néerl., vol. 8, 1873, p. 253; vol. 15, 1880, p. 370; Rév. Champ., 1892, p. 469; Cat. rais. 1904, p. 38; Cunningham in Proc. Linn. Soc. N. S. Wales, vol. 51, 1936, p. 630 — *Lycoperdon caelatum* Fr., Syst. Myc., vol. 3, 1829, p. 32 (non Bull. ex Pers., Syn. Fung., 1801, p. 141, pro syn.) — *Lycoperdon hyemale* Bull. ex Vitt., Mon. Lyc., 1842, p. 46; in Mem. Real. Acc. Sc. Torino, ser. 2, vol. 5, 1843, p. 190; Hollós in Termész. Füzt., vol. 25, 1902, p. 108; Gastr. Ung., 1904, p. 170; Alexandri in Mem. Sect. Stiint. Acad. Rom., ser. 3, vol. 9, 1932, p. 77; Cunningham, Gaster. Austr., 1942, p. 146; Bottomley in Bothalia, vol. 4, 1948, p. 551 — *Lycoperdon pratense* Lloyd, Myc. Notes, vol. 1, Lyc. Austr., 1905, p. 31; vol. 2, 1905, p. 213; vol. 2, 1906, p. 249; vol. 3, 1909, p. 439; T. C. E. Fries in Ark. f. Bot., vol. 7, no. 9, 1921, p. 36.

Fungus 1—5 cm high, 1.5—6 cm wide, height-width ratio most variable, from  $\frac{7}{4}$  to  $\frac{2}{5}$ ; upper side nearly always more or less flat, gradually, sometimes suddenly narrowing into the more or less stem-like base, sometimes sessile, subglobose or depressed; surface towards the base more or less plicate, wrinkled or indented; exoperidium consisting of fairly fugacious, white or yellowish spines, mealy granules or small scales; spines very small, often clustered and connivent; endoperidium becoming more visible in adult specimens, smooth and shiny, light brown; pore at first small, and sometimes remaining so, mostly becoming gradually larger, at last occupying half of the diameter of the upper side or more, margin irregularly torn; gleba olivaceous or umber-brown when ripe, without columella, pulverulent, easily loosening from the diaphragm; diaphragm very distinct, already present in young specimens; subgleba occupying from  $\frac{1}{3}$  to  $\frac{2}{3}$  of the total height, cellular, white to yellowish or dark purple-brown when fully ripe; cells near diaphragm not differing from those below; spores (3,1) 3.5—4.2 (4,5)  $\mu$  in diam., globose, smooth or very finely verrucose; capillitium threads up to 5.6 (8,1)  $\mu$  thick, hyaline, septate, thin-walled, flaccid, mostly granular, sparingly branched.

Habitat: growing solitary or in groups (also caespitose according to Bottomley l.c.) from July to Oct. (Febr.) amongst grass in pastures and way-sides, also found on heath; on clay, sand or calcareous soil, both moist as well as dry; sometimes in deciduous woods.

Specimens examined: Gr.: Harendermolen, 1824 or 1829, van Hall (L); Ov.: Beuningen, 1948, van Steenis (L); Enschede, 1948, Middelhoek (L); Gld.: Amersfoort, 1917, van Overeem a.o. (A); Ede, 1948, Kleijn (L); Epe, 1948, van Kregten (L); Heelsum, 1848, Buse (L); Nunspeet, 1900, Beins (GRO); Putten, 1884, Oudemans (L); Ruurlo, 1948, Agsteribbe (L); Weurt, 1848, Abeleven (L); Wilp, 1947, 1948, van Heurn (L); Utr.: Doorn, 1869, Oudemans (L, GRO, U, NBV); Leersum, 1916, Cool (L); N.H.: Amsterdam (A'damse bos), 1948, Agsteribbe (L); (IJselsemeerdijk), 1948, Agsteribbe (L); Bussum, 1902, Koning (GRO); Castricum, 1914, van Overeem (A);

Muiden, 1853, *van der Sande Lacoste* (L); Sloten, 1853, *van der Sande Lacoste* (L); Z. II.: Dordrecht, 1949, *Kinstra* (L); 's Gravenhage, 1845, *Schuurmans Stekhoven* (L); Kijkduin, *de Lint* (L); Leiden, 1944, 1949, *Perdeck* (L); 1948, *Willemse* (L); Maassluis, 1949, *Masseling* (L); Oegstgeest, 1949, *van Ooststroom* 12436, 12442 (L); Rijpwetering, 1949, *van der Heyden* (L); Voorne (Kwakjeswater) 1915, *Goethart* (L); Wassenaar, 1945, *L. B. C.* (L); 1948, *Perdeck* (L); (Rust en Vreugd), 1949, *van Ooststroom* 12433 (L); Zoeterwoude, 1944, *Perdeck* (L); Zeel.: Goes, 1845, *van den Bosch* (L); N.B.: Bergen op Zoom, 1900, *La Fontijn* (GRO); Drimmelen, 1949, *Kenniphaas* (L); Eindhoven, 1948, *Daams* (L); Scheldedijk, 1901, *La Fontijn* (GRO); Limb.: Bemelen, 1948, *Perdeck* 151 (L); Valkenburg, 1900, *Rick* (Maastr.).

**Distribution:** Europe (Sweden, Denmark, England, Netherlands, Belgium, France, Germany, Austria, Hungary, Rumania, Portugal, Italy)), S. Africa, N. America, Australia, Asia.

**Remarks:**

1. Bulliard (Hist. Champ., vol. 1, 1791, tab. 72) was the first to recognise this species, drawing attention to the diaphragm. He named the species *L. hyemale*, but since this name was published before the "starting point" (1901) it is not valid.

2. Persoon fails to give a clear description of the species. However, I found it on two sheets in his herbarium: 1. under the name *Lycoperdon candidum* (no. HLB 910. 258—507), 2. under the name *Lycoperdon hirtum* B. (no. HLB 910. 256—1273).

As to *L. candidum*, it may be stated that in his herbarium there is a second specimen under this name (no. HLB 910. 258—497), which is most certainly not *L. depressum*. This specimen is to be considered as the type of *L. candidum* Pers. (for argumentation see under this species, remark 1). So the former specimen has to be regarded as incorrectly identified.

As regards *L. hirtum*, this name cannot be used, for it is a later homonym. Persoon first used it as a synonym of *L. umbrinum* (Syn. Fung., 1801, p. 148). In 1809, however, he published it as a new species (J. de Bot., vol. 2, 1809, p. 20).

3. The same holds for the name *L. caelatum*, under which E. Fries describes the species (1829), for Persoon cites it as a synonym of his *L. bovista* (Syn. Fung., 1801, p. 141).

4. Vittadini (1843) adopts the name of Bulliard, *L. hyemale* (however, he writes "hiemale"), and gives a very good description under this name. Persoon gives this name as a synonym of his *L. plicatum* (J. de Bot., vol. 2, 1809, p. 21) and therefore it must also be rejected.

5. Bonorden (1857) calls the fungus *Lycoperdon depressum* which is the valid name.

6. Lloyd calls the species *L. pratense* Pers. Because Persoon left no specimens under this name (except some with a question-mark) and his description (Syn. Fung. 1801, p. 142) gives no decision, this is not to be recommended and it is better rejected (see under *L. candidum* Pers., remark 2).

5\*. *Lycoperdon echinatum* Pers., Syn. Fung., 1801, p. 147; in J. de Bot., vol. 2, 1809, p. 22; Hollós, Gastr. Ung., 1904, p. 95; Lloyd, Myc. Notes, vol. 2, 1905, p. 208, 222; Petri, Fl. Ital. Crypt., pars 1, fasc. 5, 1909, p. 42; T. C. E. Fries in Ark. f. Bot., vol. 17, no. 9, 1921, p. 25.

Killermann, Krypt. Forsch., vol. 1, 1926, p. 503 — *Lycoperdon constellatum* Fr., Syst. Myc., vol. 3, 1829, p. 39.

Distribution: Europe (Sweden, England, France, Germany, Hungary, Italy), N. America.

Remarks:

1. This species has not yet been found in the Netherlands. All cases in which its occurrence in this country is claimed and in which I was able to examine the specimens in question, appeared to be *Lycoperdon perlatum* Pers., mostly var. *nigrescens* Pers.

2. In the herbarium of Persoon good specimens of this species are present. Lloyd has indicated no. HLB 910. 258—504 as the type.

6. *Lycoperdon molle* Pers., Syn. Fung., 1801, p. 150; in J. de Bot., vol. 2, 1809, p. 18 (non Trelease in Trans. Wisconsin. Ac., vol. 7, 1889, p. 115; Morgan in J. Cincinnati. Soc. Nat. Hist., vol. 14, 1891, p. 17; Hollós, Gastr. Ung., 1904, p. 112; Petri, Fl. Ital. Crypt., pars 1, fasc. 5, 1909, p. 39) — *Lycoperdon quercinum* Pers., Syn. Fung., 1801, p. 148; in J. de Bot., vol. 2, 1809, p. 18 (pro syn.) — *Lycoperdon turbinatum* Pers. in J. de Bot., vol. 2, 1809, p. 18 — *Lycoperdon atropurpureum* Vitt., Mon. Lye., 1842, p. 42; in Mem. Real. Acc. Sc. Torino, ser. 2, vol. 5, 1843, p. 186 — *Lycoperdon umbrinum* Hollós, Gastr. Ung., 1904, p. 96; Lloyd, Myc. Notes, vol. 2, no. 19, 1905, p. 209; T. C. E. Fries in Ark. f. Bot., vol. 17, no. 9, 1921, p. 25; Nüesch, Jahrb. St. Gall. Nat. Ges., vol. 65, 1929—1930, p. 123 (non Pers., Syn. Fung., 1801, p. 147; Icon. pict. fung., vol. 3, 1803, p. 43, tab. 18, fig. 3; in J. de Bot., vol. 2, 1809, p. 19).

Fungus 2.5—8 cm high, 2.5—6 cm wide, height-width ratio from  $\frac{2}{1}$  to  $\frac{1}{1}$ ; mostly gradually narrowing into the stem, pear-shaped, but sometimes sessile or with a distinct stem, with all transitions between these extremes; exoperidium mostly consisting of white or brownish, fine, stellately clustered small spines, or of granules of varying proportion; often with combinations of or transitions between spines and granules; endoperidium smooth, tender, yellowish or brown; pore irregular, up to  $\pm 5$  mm in diam.; gleba umber- or purplish-brown when mature, sometimes with a more or less distinct columella; subgleba not sharply separated from the gleba, occupying  $\frac{1}{5}$  to  $\frac{2}{3}$  from the total height, cellular, pale brown or purplish brown (when mature); spores 4.2—5.6 (6.3)  $\mu$  in diam., globose, strongly warted when mature (at an enlargement of  $450\times$  the warts are already distinctly visible); often mixed with fallen pedicels; threads of capillitium to 5.6 (7.0)  $\mu$  thick, coloured, mostly pretty strongly ramose.

Habitat: in several types of woods, solitary or in groups from Aug. to Oct.

Specimens examined: Gld.: Nunspeet, 1898, *Beins* (GRO); Oosterbeek, 1948, *Gremmen* (L); Ruurlo, 1948, *Agsteribbe* (L); N.H.: Bussum, 1916, 1917, *van Overeem* a.o. (A); Haarlem, *Splitgerber* (L); Z.H.: Kijkduin, *de Lint* (L); Wassenaar (Duinrell), 1948, *Perdeck* 155, 161, 168 (L); N.B.: Eindhoven, 1948, *Daams* (L); Limb.: Valkenburg, 1900, *Rick* (GRO); Vlodrop, 1948, *Holthuis* (L).

Distribution: Europe (Sweden, Netherlands, France, Germany, Austria, Czechoslovakia, Hungary, Rumania, Portugal, Spain, Italy), S. Africa, N. America.



## Remarks:

1. This species is sometimes difficult to distinguish from *Calvatia excipuliformis*, which, however, never has a purple gleba and a columella.

2. Several authors (e. g. Lloyd, Myc. Notes, 1905, p. 209—210; Alexandri in Mem. Sect. Stiint. Acad. Rom., ser. 3, vol. 9, 1932, p. 76; Kambly and Lee in Univ. of Iowa Stud., vol. 17, 1936, p. 142—143) distinguish a number of allied species, which are only varieties according to Hollós (l. c.) and Nüesch (l. c.). *Lycoperdon velatum* Vitt., however, seems to me to be a distinct species (see especially Lohwag in Beih. Bot. Centralbl., vol. 51, 1933, p. 274). It is characterised by the soft white veil, which completely covers the plant in early stages and, as the plant develops, breaks up into ragged pieces which partly adhere loosely to the endoperidium or finally fall away. It is found in Europe (Italy, Austria, Hungary, France) and N. America.

3. In Persoon's herbarium there are six numbers of *L. molle*, with a label of Persoon (and without a question-mark). One of these (no. HLB 910. 258—463) is immature and therefore not recognisable; another one (no. HLB 910. 258—466) is *L. perlatum*. Here an accidental change of labels must have occurred, for I found another specimen of the species in question under the name *L. perlatum* (no. HLB 910. 258—472, already discovered by Lloyd; cf. also Myc. Notes, vol. 2, 1905, p. 209 note). Of the four remaining specimens one is *L. ericetorum* Pers. (specimen with stem!) (no. HLB 910. 258—470) and the three others (no. HLB 910. 258—467, 910. 258—468, 910. 258—472) belong to the species with which we are dealing here (purple gleba; strongly warted spores). Since the name is properly published, the valid name is *Lycoperdon molle* Pers. Lloyd (Myc. Notes, vol. 2, 1907, p. 345), after his visit at Leyden, came to the same conclusion, but did not use this name.

4. The specimens Persoon left of his *L. turbinatum* (no. HLB 910. 258—649) prove that this species is the same as *L. molle*. Persoon himself had noted already on the label under the first name: "*L. mollis* varietas?" Lloyd came to the same conclusion, as appears from a label written by him.

5. *L. quercinum* Pers. (1801) is synonymous with *L. molle* according to the author himself (1809). He left no material under this name.

6. Vittadini (1842) was the first to give a clear description of the species under the name *L. atropurpureum*, of which Lloyd has seen the type (Myc. Notes, vol. 7, 1923, p. 1222).

7. Up to this time the species has generally been known under the name *L. umbrinum* Pers. It was so called for the first time by Hollós (1904), who based his conclusion on Persoon's descriptions and picture of this species. This is not right, for the type specimen of *L. umbrinum* (see under this species, p. 503), though mature, shows only finely verrucose spores, and no purple gleba.

8. What was called *Lycoperdon molle* Pers. by Trelease (1889), Morgan (1891), Hollós (1904) and Petri (1909) is not this species, but judging from the descriptions, *L. spadiceum* Pers.

9. Very probably Oudemans (Rév. Champ., 1892, p. 467, Cat. rais.,

1904, p. 39) called this species *L. hirtum* Mart., judging from his description, for he left no cited material under this name.

7. *Lycoperdon candidum* Pers., Syn. Fung., 1801, p. 146; Icon. et Deser. Fung., vol. 2, 1798—1800, p. 53, tab. 13, fig. 4; in J. de Bot., vol. 2, 1809, p. 22 — *Lycoperdon cruciatum* Rostk. in Sturm, Deutschl. Fl., vol. 3, fasc. 18, 1839, p. 19, tab. 8; Lloyd, Myc. Notes, vol. 1, 1902, p. 83, 112; vol. 2, 1905, p. 214, 231 — *Lycoperdon marginatum* Vitt., Mon. Lye., 1842, p. 41; in Mem. Real. Acc. Sc. Torino, ser. 2, vol. 5, 1843, p. 185; Lloyd, Myc. Notes, vol. 1, 1902, p. 112; vol. 7, 1923, p. 1222; Petri, Fl. Ital. Crypt., pars 1, fasc. 5, 1909, p. 41; Kambly and Lee in Univ. of Iowa Stud., vol. 17, 1936, p. 143 — *Lycoperdon separans* Peck in N. York Nat. Hist. Mus., vol. 26, 1874, p. 73; Morgan, in J. Cincinnati Soc. Nat. Hist., vol. 14, 1891, p. 14; Lloyd, Myc. Notes, vol. 1, 1902, p. 83 — *Lycoperdon Wrightii* B. et C. var. *separans* Peck in N. York Nat. Hist. Mus., vol. 29, 1878, p. 67; Lloyd, Myc. Notes, vol. 1, 1903, p. 153; vol. 2, 1905, p. 232 — *Lycoperdon papillatum* Schaeff. ex Hollós, Gastr. Ung., 1904, p. 108; Killermann, Krypt. Forsch., vol. 1, 1926, p. 506.

Description partly after Morgan and Hollós.

Fungus 1.0—2.5 cm high, 1.2—5 cm wide, subglobose hemispheric, often depressed; exoperidium (fig. 6) consisting of a dense coat of white, stout spines, convergent at the apex in little groups, becoming smaller at the base, falling off in irregular patches at maturity; endoperidium thin, mealy, at last smooth and shiny, yellowish or pale brown; gleba pale or dark brown, mostly without a distinct columella; subgleba pretty sharply separated from the gleba, but without diaphragm, occupying from  $\frac{1}{5}$  to  $\frac{1}{3}$  of the total height, sometimes scanty, cellular; spores 3.5—4  $\mu$  in diam. globose, smooth; threads of capillitium 2.1—4.9  $\mu$  thick, coloured, not or hardly branched.

Habitat: on grass-fields, sometimes on stumps, July, August; rare.

Specimens examined: only one specimen has been found in the Netherlands: Gld.: Hoenderlo, Aug. 1877, *Oudemans* (L).

Distribution: Europe (Netherlands, France, Germany, Austria, Hungary, Italy), N. America.

Remarks:

1. Persoon has left in his herbarium two sheets with specimens of this species. To one of them, no. HLB 910.258—501, he has written: "*Lycoperd. depressum* spec. nova?", but he never published it under this name. As appears from a label, Lloyd already identified the specimens as *L. cruciatum* and he added: "It is I think *L. candidum* of Pers. Icon." cf. Myc. Notes, vol. 2, 1907, p. 345. The other one, no. HLB 910.258—497 bears the name *Lycoperdon candidum*, with the note "Syn. fung. p. ... et Icones fungor. Fasc. t. ...", all written by Persoon. Now there are in his herbarium two other sheets bearing the name *L. candidum* in Persoon's handwriting. One, no. HLB 910.258—507, is *L. depressum* Bon., the other, found in N. America, no. HLB 911.18—197, *L. wrightii* B. et C. (var. *typicum* Peck). (For further particulars about the latter species, which according to Hollós is identical with *L. depressum* Bon., see Lloyd, Myc. Notes, vol. 2, 1905, p. 232, 1906, p. 271; 1907, p. 324). On the label of this specimen Persoon wrote "*Lycoperdon candidum* Syn. fung. Am.

Bor." Of these three different species, all bearing the name *L. candidum*, in my opinion no. HLB 910.258—497, must be considered as the real *L. candidum* Pers., and therefore becomes the type-specimen. I base this viewpoint on his description and especially on the figures in Icon. et Deser. Fung., l.e. These illustrations show a *Lycoperdon* with stout, white convergent spines, just as they are characteristic for the species under discussion. Furthermore, the figures resemble exactly the last-mentioned specimen, not the other specimens which are *L. depressum* and *L. wrightii*. The valid name of the species in question therefore is now *Lycoperdon candidum* Pers. Lloyd, Myc. Notes, vol. 2, 1905, p. 215, came to the same conclusion, stating: "Everything points to *L. candidum* of Persoon". It was, however, not correct for Lloyd to state that there are no specimens under this name in Persoon's herbarium (Myc. Notes, vol. 2, 1907, p. 345).

2. Hollós, l.e., calls the species *L. papillatum* Schaeff., and gives as a synonym among others *L. pratense* Pers., most probably because Persoon, in his description of *L. pratense*, gives *L. papillatum* Schaeff. as a synonym (Syn. Fung., 1801, p. 142). However, to judge from his description, Persoon meant something else with *L. pratense*, for he states about the spines: "verrucae obsoletae" and "verrucae parvis" whereas *L. candidum* has always very distinct spines. So, if *L. papillatum* Schaeff. is considered identical with *L. candidum*, *L. pratense* cannot be a synonym of *L. candidum*. There are more reasons not to use the name *L. pratense* (see under *L. depressum* Bon., remark 6).

3. The only known specimen found in the Netherlands was identified by Oudemans as *L. gemmatum* Batsch. var. *papillatum* Schaeff. (Arch. Néerl., vol. 15, 1880, p. 373). Of the other material, cited to have been found in Westland, no specimens are left (also cited in Prodr. Fl. Bat., vol. 2, pars 4, 1866, p. 13; Ned. Kruidk. Arch., ser. 2, vol. 5, 1891, p. 370).

8. *Lycoperdon umbrinum* Pers., Syn. Fung., 1801, p. 147; Icon. pict., 1803, p. 43, tab. 18, f. 3; in J. de Bot., 1809, p. 19 (non Hollós, Gastr. Ung., 1904, p. 96; Lloyd, Myc. Notes, vol. 2, no. 19, 1905, p. 209; T. C. E. Fries in Ark. f. Bot., vol. 17, no. 9, 1921, p. 25; Nüesch, Jahrb. St. Gall. Nat. Ges., vol. 65, 1929—1930, p. 123).

Fungus 2—4.5 cm high, 1.5—3 cm wide, height-width ratio  $\frac{1}{1}$  to  $\frac{3}{2}$ ; more or less pear-shaped, stem distinct or not; exoperidium (fig. 7) consisting of very small, slender, dark spines, which nearly cover the whole surface; spines mostly different in length, with a somewhat thickened persistent base, often several spines connivent at the apex, but never regularly placed in groups, and never leaving bright areoles when they have fallen off; endoperidium white or yellowish brown, shiny; pore not very regular, 4—5 mm in diam.; gleba olive or umber brown, with a more or less distinct columella; subgleba unsharply separated from the gleba, occupying  $\frac{2}{5}$  to  $\frac{3}{5}$  of the total height, cellular, whitish, dark or purplish brown; root consisting of small, ramose fibres; spores 3.5—4.5  $\mu$  in diam., smooth or finely verrucose, globose; threads of capillitium up to 4.2 (5.6)  $\mu$  thick, coloured, not very strongly ramose.

Habitat: in woods, mostly solitary, Aug. to Oct.

Specimens examined: Gld.: Brummen, 1861, Oudemans (GRO); N.B.: Bostel-Best, 1946, Maas Geesteranus 3429 (L); Eindhoven, 1946, Maas Geesteranus 3432 (L); 1948, Daams (L).



**Distribution:** since the author does not know under which names this species is given by others, he cannot say anything about the distribution.

**Remarks:**

1. The species is sometimes difficult to be distinguished from *L. perlatum*. Note the less distinct columella and structure of the exoperidium.

2. Thanks to the presence of one specimen under the name *L. umbrinum*, written by Persoon, in his herbarium (no. HLB 911.81—14), which is to be considered as the type-specimen, I could establish with certainty what Persoon understood by this species. It appeared that Persoon's descriptions and figure of this species are always misunderstood. What now is to be called *L. molle* Pers. (see also under this species) was called *L. umbrinum* Pers. by Hollós and other authors. Decisive are the but finely verrucose spores and the brown, not purple gleba of the type.

3. It is probable that this is the species called by Hollós (Gastr. Ung., 1904, p. 104) and Lloyd (Myc. Notes, vol. 2, 1905, p. 210, 227) *L. fuscum* Bon. However, Hollós speaks of white spines, and Lloyd of rough spores. Bonorden's description (Bot. Zeit., vol. 15, 1857, p. 626) gives no solution and his specimen in Focke's herbarium, which according to Lloyd might be the type-specimen, has been identified by the same to be *Lycoperdon spadiceum* (Myc. Notes, vol. 2, 1906, p. 291).

9. ***Lycoperdon perlatum*** Pers., Syn. Fung., 1801, p. 145; in J. de Bot., vol. 2, 1809, p. 20; Vittadini, Mon. Lye., 1842, p. 50; in Mem. Real. Acc. Sc. Torino, ser. 2, vol. 5, 1843, p. 194; T. C. E. Fries in Ark. f. Bot., vol. 17, no. 9, 1921, p. 27; Cunningham in Proc. Linn. Soc. N. S. Wales, vol. 51, 1926, p. 633; Gaster. Austr., 1942, p. 149; Kambly and Lee, in Univ. of Iowa Stud., vol. 17, 1936, p. 146; Bottomley in Bothalia, vol. 4, 1948, p. 554 — *Lycoperdon gemmatum* Fries, Syst. Myc., vol. 3, 1829, p. 36; Westendorp in Prodr. Fl. Bat., vol. 2, pars 4, 1866, p. 13; Oudemans in Arch. Néerl., vol. 15, 1880, p. 372; Rév. Champ., 1892, p. 469; Cat. rais., 1904, p. 39; Hollós, Gastr. Ung., 1904, p. 102; Lloyd, Myc. Notes, vol. 2, 1905, p. 211; Petri, Fl. Ital. Crypt., pars 1, fasc. 5, 1909, p. 38; Alexandri in Mem. Sect. Stiint. Acad. Rom., ser. 3, vol. 9, 1932, p. 72 — *Lycoperdon tasmanicum* Mass., in Kew Bull., 1901, p. 158 — *Lycoperdon macrogemmatum* Lloyd, Myc. Notes, vol. 2, 1906, p. 265 — *Lycoperdon turbinatum* Lloyd, Myc. Notes, vol. 4, 1906, p. 265 (non Pers., non B. et C.).

Fungus 1.2—6.5 cm high, 1.1—5.5 cm wide, height-width ratio  $1\frac{1}{2}$  to  $2\frac{1}{1}$ , very variable, sessile or with a more or less distinct stem, often plicate between head and stem; exoperidium always with distinct spines; mostly there is an increasing difference in length between the spines from the base upwards to the apex of the fungus; the big spines each being surrounded by a ring of small ones are deciduous, leaving a pale areole when they have fallen off, whereas the small spines do not fall off so easily; in this way the exoperidium forms a typical reticulate structure (fig. 9). Instead of one big spine there are often a number of them, mostly 4—6. They are more or less grown together, and may be connected only at the base and the apex; they fall off together and as a group are surrounded by small ones (fig. 11); this reticulate structure is mostly very distinct, only being indistinct in var. *bonordeni*, whereas it is hardly developed at

all in young specimens; the shape of the spines is very different; colour white, yellow, brown or almost black; endoperidium white, yellow or pale brown; pore 3—6 (10) mm in diam., mostly regular; gleba olive or umber brown when mature, always with a distinct, mostly very regular columella; subgleba often fairly well separated from the gleba, occupying  $\frac{4}{5}$  to  $\frac{1}{4}$  of the total height; cellular, white or pale brown; root mostly not very strongly developed, sometimes a group of specimens, as a rule young ones, connected by white cord-like roots, just as in *L. pyriforme* Pers.; spores 3.5—4.5 (4.9)  $\mu$  in diam., globose, finely warted; threads of capillitium up to 4.5 (5.6)  $\mu$  thick, coloured, often granular, mostly little branched; often mixed with hyaline, septate threads — *fig. 8*.

**Habitat:** nearly always in woods of several types; mostly caespitose, but also in groups or solitary; July to Nov. (March).

**Distribution:** Europe (Sweden, Denmark, England, Netherlands, Belgium, France, Germany, Switzerland, Austria, Hungary, Rumania, Portugal, Italy), Africa, America, Australia.

**Remarks:**

1. The specimens in Persoon's herbarium leave no doubt that his *L. perlatum* is the species we are dealing with (see e.g. the specimens no. HLB 910.258—678, 910.258—676, 910.258—671). Persoon already used the name *L. gemmatum* as a synonym in his works.

2. The great-variability of this species has led to much confusion. So, during a long time it was assumed that there were two species, *L. gemmatum* Fr. and *L. perlatum* Pers. According to Masee (J. Roy. Micr. Soc., 1887, p. 710) *L. perlatum* was characterized by the presence of a columella and an umbo, and *L. gemmatum* by the absence of these characters. Oudemans (i.e., 1892) adopted this view too. Morgan (J. Cincinn. Soc. Nat. Hist., vol. 14, 1891, p. 13) distinguished the two species by the colour of the spines, *L. perlatum* having greyish, brown or black spines, *L. gemmatum* white or grey. Hollós and Lloyd noted the identity of these two species, but they both failed to give a clear account of the variability of the species.

### Key to the varieties.

The following varieties are based on the structure of the exoperidium.

- 1a. Big spines either simple and thick, or consisting of a number of thinner ones, which are closely grown together at full length.
- 2a. With a very distinct reticulate structure, the big spines being regularly surrounded by small spines, and leaving a paler areole when fallen off (which they easily do) (*fig. 9*) . . . . . **var. typicum**
- 2b. Without a distinct reticulate structure, either since there is no distinct differentiation between big and small spines, or since the small spines are very rudimentary, or since the small spines do not surround the big ones regularly; spines mostly not falling off easily (*fig. 10*) . . . **var. bonordeni**
- 1b. Big spines slender and curved, standing together in little groups (each group mostly consisting of 4—6 spines) and at most grown together only at the base and the top of the spines. Mostly with a distinct reticulate structure (*fig. 11*) . . . . . **var. nigrescens**

**Lycoperdon perlatum** Pers. **var. typicum** — *Lycoperdon gemmatum* Fr. **var. perlatum** (Pers.) Fr., Syst. Myc., vol. 3, 1829, p. 37 — for further synonyms see above.

Big spines either simple and thick, or consisting of a number of thinner ones, which are closely grown together at full length; exoperidium with a very distinct reticulate structure, because of the big spines being regularly surrounded by small spines, and leaving a paler areole when they have fallen off (which they easily do) (fig. 9); spines straight, white or yellowish brown. Nearly always caespitose.

Specimens examined: Gr.: Groningen (Oranjezon), 1863 (GRO); Gld.: Apeldoorn, 1877, *Oudemans* (GRO); Epe, 1948, *van Kregten* (L); Heelsum, *Buse* (L); Hoge Veluwe, 1948, *van der Hammen* (L); Kotten, 1949, *van Ooststroom* 11387 (L); Nieuw Milligen, 1948, *Hoogland* (coll. Hoogland); Ruurlo, 1948, *Agsteribbe* (L); Wageningen, 1948, *Boetje—van Ruyven* (L); 1948, *Gremmen* (L); Warnsveld, 1892, *Oudemans* (L); Wilp, 1945, 1948, *van Heurn* (L); Utr.: Lage Vuursche, 1917, *van Overeem* a. o. (A); 1948, *Kleijn* (L); Maarn, 1948, *Agsteribbe* (L); Maarsbergen, 1948, *Agsteribbe* (L); Over-Holland, 1948, *Agsteribbe* (L); N. H.: Bergen, 1948, *Heybroek* (L); Bussum, 1915, *Boedijn* (A); 1916, *van Overeem* a. o. (A); Hilversum, 1914, *Toxopeus* (A); 1916, *Boedijn* (A); Huizen, 1948, *Heybroek* (L); Vogelenzang, 1948, *Kleijn* (L); Z. H.: Leiden (Zuidwijk), *Molkenboer* (L); Noordwijk, 1948, *van Ooststroom* 11036 (L); Warmoud, 1949, *van Ooststroom* 12454 (L); Wassenaar, 1913, *ten Kate*, monstrem (L); Duinrell, 1948, *Vervoort* (L); 1948, *Maas Geesteranus* 3240 (L); 1948, *Perdeck*, 187 (L); (Meiendel), 1948, *Perdeck*, 159, 178—181 (L); N. B.: Tilburg, 1945, *Liernur* (L); Limb.: Valkenburg, 1900, *Rick* (GRO); Vlodrop, 1948, *Holthuis* (L).

***Lycoperdon perlatum* Pers. var. *bonordeni* (Mass.) Perdeck nov. comb.**

— *Lycoperdon hirtum* Bon. in Bot. Zeit., vol. 15, 1857, p. 631 — *Lycoperdon Bonordeni* Mass. in J. Roy. Micr. Soc., 1887, p. 713.

Big spines either simple and thick, or consisting of a number of thinner ones, which are closely grown together at full length; exoperidium without a distinct reticulate structure, either because there is no distinct differentiation between big and small spines, or since the small spines are very rudimentary, or since the small spines do not surround the big ones regularly (fig. 10); spines mostly not easily falling off and very variable in form, mostly dark-coloured. Caespitose, in groups or solitary.

Specimens examined: Gr.: Paterswolde, 1832, *van Hall* (U); 1830, *van Hall* (L); Gld.: Apeldoorn, 1915, *van Overeem* (A); Brummen, 1863, *Oudemans* (GRO); Eerbeek, 1942, *Koster* 771 (L); Lunteren, 1944, *Maas Geesteranus* 3048 (L); N. Milligen, 1948, *Hoogland* (coll. Hoogland); Nunspeet, 1898, *Beins* (L); Renkum, 1851, *Buse* (L); Ruurlo, 1948, *Agsteribbe* (L); Utr.: Doorn, 1869, *Oudemans* (GRO, L, U); Leersum, 1948, *Agsteribbe* (L); N. H.: Aerdenhout, *Splitgerber* (L); Bussum, 1916, *van Overeem* a. o. (A); Hilversum, 1915, *van Overeem* a. o. (A); 1914, *Kaiser* (A); Vogelenzang, 1948, *Kleijn* (L); Z. H.: Kijkduin, *de Lint* (L); Leiden, *Molkenboer* (L); *van der Sande Lacoste* (NBV); 1845, *Oudemans* (L); (Zuidwijk), 1843, *van der Sande Lacoste* (L); Wassenaar (Duinrell), 1948, *van Ooststroom* 11058 (L); 1948, *Perdeck* 156, 157, 188 (L); (Raaphorst), 1948, *Perdeck* 168 (L); N. B.: Breda, 1865, *Oudemans* (GRO); Eindhoven, 1948, *Daams* (L); Limb.: Mechelen, 1949, *Hoogland* (coll. Hoogland).

#### Remarks:

1. As appears from specimens in his herbarium, Persoon already classed this variety under *L. perlatum* (see e. g. no. HLB 910.258—681, 910.258—682, 910.258—761). There are in his herbarium some more specimens of this variety (no. HLB 910.256—1275) which Persoon called *Lycoperdon obscurum*, but he never published this name. On the label he wrote: “species a *L. perlato* differre videtur”.

2. In my opinion it is clear that Bonorden (l. c.) meant this variety with his *L. hirtum*. I cite the most important sentence of his description: “Sie unterscheidet sich aber von *L. gemmatum* dadurch, dass die Stacheln nicht von kleineren kreisförmig umstellt sind, dass diese nicht abfallen,



sondern antrocknen und somit keine Arcolen hinterlassen etc.". However, the name *L. hirtum* was already used in another sense, so Massee (l.c.) called the species *Lycoperdon bonordeni*. I consider this species as a variety for I found transitions between it and *L. perlatum* var. *typicum* and *L. perlatum* var. *nigrescens*.

3. The specimens called *L. hiemale* by Westendorp (Prodr. Fl. Bat., vol. 2, pars 4, 1836, p. 14) appeared to be this variety, as is also partly the case with the specimens he called (l.c. p. 13) *L. gemmatum* var. *excipuliforme* Scop., *L. gemmatum* var. *perlatum* Pers. and *L. gemmatum* var. *furfuraceum* Fr. Oudemans called this variety mostly *L. gemmatum* var. *perlatum* (specimens in herb. GRO).

***Lycoperdon perlatum* Pers. var. *nigrescens* Pers., Syn. Fung., 1801, p. 146; Killermann, Krypt. Forsch., vol. 1, 1926, p. 505 — *Lycoperdon nigrescens* (Pers.) Lloyd, Myc. Notes, vol. 2, 1905, p. 212, 229, 338; T. C. E. Fries in Ark. f. Bot., vol. 17, no. 9, 1921, p. 28.**

Big spines dark coloured, slender and curved, standing together in little groups, each group consisting mostly of 4—6 spines, and at most grown together only at the base and the top of the spines; exoperidium mostly with a distinct reticulate structure (fig. 11). Mostly in groups.

Specimens examined: Fr.: Oranjewoud, 1949, *van Foreest* (L); Dr.: Vlederveen, 1948, *Siebering* (L); Ov.: Diepenveen, 1916, *Vuyck* (L); Gld.: Oosterbeek, 1948, *Gremmen* (L); Renkum, 1848, 1850, *Buse* (L); Wageningen, 1849, *Buse* (L); Wilp, 1945, 1946, *van Heurn* (L); Utr.: Baarn, 1948, *Hueck* (L); Maarsbergen, 1948, *Duin* (L); Oud-Leusden, 1948, *Perdeck*, 150 (L); N. H.: Bussum, 1913, 1916, *van Overeem* a. o. (A); 1915, *Boedijn* (A); Z. H.: Leiden, *Molkenboer* (L); Warmond, 1949 *van Ooststroom* 12471 (L); Wassenaar, *Molkenboer* (L); (Duinrell) 1948, *Maas Geesteranus* 3235 (L); (Raaphorst), 1948, *Maas Geesteranus* 3251 (L); 1948, *Perdeck* 160, 167, 169, 170, 192, 193 (L); 1948, *Leidse Biologen* (L); N. B.: Bergen op Zoom, 1901, *La Fontijn* (GRO); Eindhoven, 1948, *Daams* (L); Limb.: 1900, *Rick* (Maastr.).

**Distribution:** Europe (Sweden, England, Netherlands, Germany, Austria), N. America.

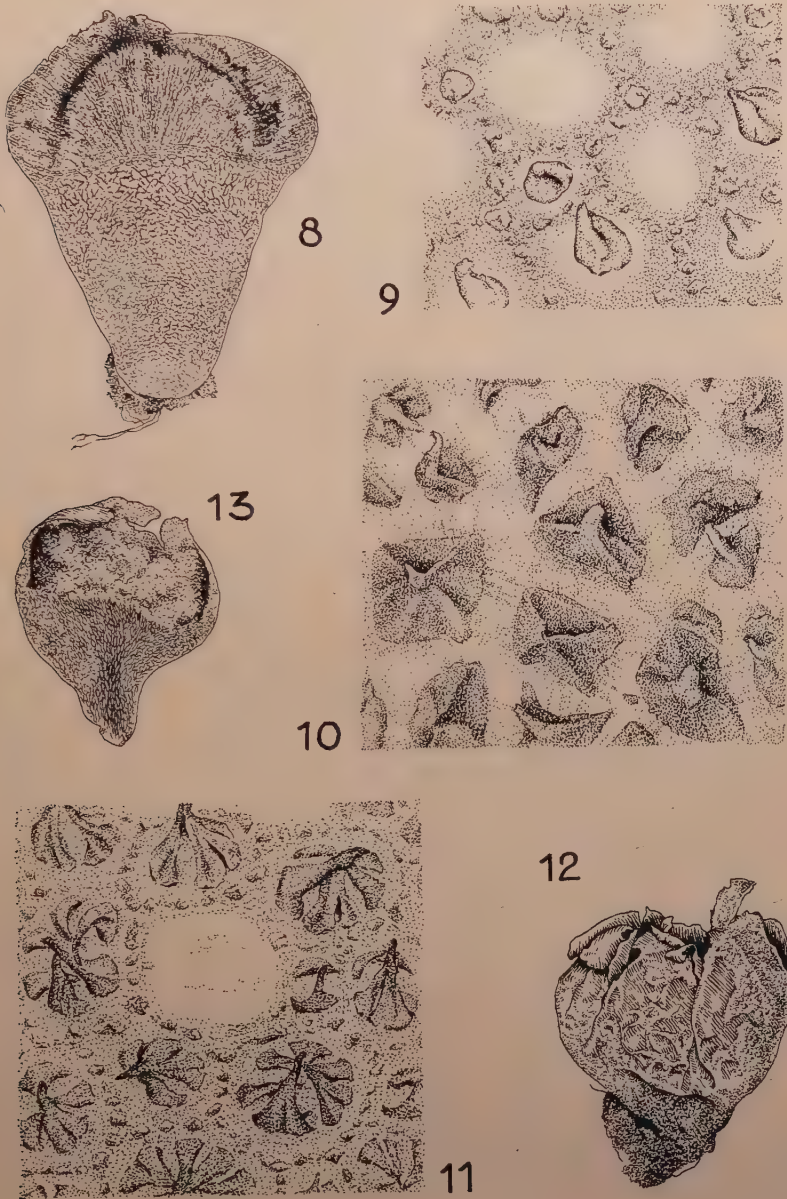
#### Remarks:

1. Going by the description which Persoon in 1801 (Syn. Fung. l.c.) gave of his var. *nigrescens* it is not clear that he meant what we now understand by this variety, since he only stated the dark colour of the spines. However, our hesitation turns into certainty when reading his remark in J. de Bot., vol. 2, 1809, p. 21: "La variété de mon Synops. fung. paraît une espèce distincte, parce que les aiguillons sont plus forts et presque point réunis ensemble" (spaced by me, P.). In my opinion, the characters are not sufficiently sharp to make it a distinct species, as was done by Lloyd and T. C. E. Fries.

2. In Persoon's herbarium there is no material under this name. There exists a specimen of this variety under the name *L. nigricans* (no. HLB 910.258—477), to which Persoon added: "var. *perlati*", see Lloyd, Myc. Notes, vol. 2, 1905, p. 212.

3. Judging from the descriptions I suppose that the following species belong to this variety: *L. foetidum* Bon. in Bot. Zeit., vol. 15, 1857, p. 629 and *L. duthei* Bottomley in Bothalia, vol. 4, 1948, p. 555.

4. To this variety also belong the specimens named *L. gemmatum* Batsch. var. *echinatum* Pers. by Westendorp (Prodr. Fl. Bat., vol. 2,



J.T.'49.

Fig. 8 — *Lycopodium perlatum* Pers., longitudinal section, nat. size; 9 — *L. perlatum* Pers. var. *typicum*, structure of exoperidium, enlarged; 10 — *L. perlatum* Pers. var. *bonordeni* (Mass.) Perdeck, structure of exoperidium, enlarged; 11 — *L. perlatum* Pers. var. *nigrescens* Pers., structure of exoperidium, enlarged; 12 — *Bovistella radicata* (Dur. et Mont.) Pat., nat. size; 13 — *B. radicata* (Dur. et Mont.) Pat., longitudinal section, nat. size.

pars 4, 1866, p. 13) and Oudemans (Arch. Néerl., vol. 15, 1880, p. 372; Rév. Champ., 1892, p. 463), and *L. molle* Pers. by Westendorp (l. c., p. 14) and *L. echinatum* Pers. by Oudemans (Cat. rais., 1904, p. 38).

10. *Lycoperdon pyriforme* Pers., Syn. Fung., 1801, p. 148; in J. de Bot., vol. 2, 1809, p. 19; Fries, Syst. Myc., vol. 3, 1829, p. 38; Hollós, Gastr. Ung., 1904, p. 111; Lloyd, Myc. Notes, vol. 2, 1905, p. 212; Petri, Fl. Ital. Crypt., pars 1, fasc. 5, 1909, p. 36; T. C. E. Fries in Ark. f. Bot., vol. 17, no. 9, 1921, p. 28; Cunningham in Proc. Linn. Soc. N. S. Wales, vol. 51, 1926, p. 632; Gaster. Austr., 1942, p. 149; Killermann, Krypt. Forsch., vol. 1, 1926, p. 506; Alexandri in Mem. Sect. Stiint. Acad. Rom., ser. 3, vol. 9, 1934, p. 78; Kambly and Lee in Univ. of Iowa Stud., vol. 17, 1936, p. 146 — *Lycoperdon saccatum* Pers., in J. de Bot., vol. 2, 1809, p. 19 (non Vahl, nec Fries).

Fungus 2—5 (6) cm high, 1.5—3 cm wide, height-width ratio  $\frac{2}{1}$  to  $\frac{1}{1}$ ; mostly with a stem, which merges into the head gradually, or sometimes suddenly; sometimes sessile; exoperidium mostly consisting of very small, crowded warts, which are white or yellowish in young, dark brown in adult specimens; these warts are sometimes more mealy-granular, sometimes more spinulose scaly; rarely they are distinct small spines, persistent; endoperidium pale brown sometimes shiny; pore up to about 4 mm in diam., not very regular; gleba olive or umber brown when ripe, with a very distinct regular columella, which is free from the rest of the gleba; subgleba not sharply separated from the gleba, occupying  $\frac{5}{7}$  to  $\frac{3}{7}$  of the total height, finely cellular, white or pale brown, always paler than the gleba when ripe; root strongly developed, forming thick ramose, white cords, which connect the specimens of a group; spores 3.4—4.9  $\mu$  in diam. globose, smooth or nearly so; threads of capillitium up to 6.3  $\mu$  thick, coloured, often granular, ramose; often mixed with hyaline, septate threads.

Habitat: on old logs and stumps, more rarely on the ground, mostly caespitose; Aug. to Nov.

Specimens examined: Gld.: Doetinchem, 1915, *Exc. N.N.V.* (L); Lage Vuursche, 1948, *Kleijn* (L); Middachten, 1936, *Nannenga* (U) 1948, *Schweers* (L); Ubbergen, 1866, *van Hall* (L); Wageningen, *de Lint* (L); Winterswijk, 1918, *ten Houten* (L); N. H.: Bloemendaal, 1915, *Cool* (L); Z. H.: Dordrecht, 1945, 1949, *Kinstra* (L); Limb.: Mechelen, 1949, *van Tooren* (coll. Hoogland); Valkenburg, 1900, *Rick* (Maastr.).

Distribution: Europe (Sweden, Denmark, England, Netherlands, Belgium, France, Germany, Switzerland, Austria, Czechoslovakia, Hungary, Rumania, Bulgaria, Spain, Italy), America, Australia, Asia.

#### Remarks:

1. In the herbarium of Persoon there exists only one sheet with this species to which a label is added written by Persoon; he noted on the label: "var. umbone nullo aut obsoleto" (no. HLB 910.258—341). This is the type.

2. As appears from the only specimen (no. HLB 910.258—641) Persoon left of his *L. saccatum* Pers. (non Vahl aut Fries), this species is identical with *L. pyriforme*.

3. All specimens called *L. piriforme* Rüpp. by Westendorp and Oudemans appeared to be *L. spadiceum*. Most probably they did not know the real *L. pyriforme*.



11. *Lycoperdon spadiceum* Pers. in J. de Bot., vol. 2, 1809, p. 18; Hollós, Gastr. Ung., 1904, p. 113; Lloyd, Myc. Notes, vol. 2, 1905, p. 216; Killermann, Krypt. Forsch., vol. 1, 1926, p. 507; Cunningham in Proc. Linn. Soc. N. S. Wales, vol. 51, 1926, p. 635; Gaster. Austr., 1942, p. 151—*Lycoperdon lividum* Pers. in J. de Bot., vol. 2, 1809, p. 18.

Fungus 1.2—5 (9) cm high, 1—4 (6) cm wide, height-width ratio  $2\frac{1}{1}$  to  $3\frac{1}{4}$ ; sessile or with a more or less distinct stem; exoperidium in young specimens consisting of crowded spinulose granules, which are mostly grey in the upper and white in the under part of the fungus; in older specimens the surface is nearly smooth or finely granular, or mealy; the stem shows often dark brown, warty, small scales; distinct spines always wanting; often with small cracks, sometimes with scattered white granules (lime?); endoperidium yellowish, shiny; pore 1—5 mm in diam., mostly regular, often somewhat mammose; gleba olive or umber brown when ripe, with an irregular, little developed columella, which is not free from the rest of the gleba; subgleba pretty sharply separated from the gleba, without diaphragm, occupying  $\frac{7}{10}$  to  $\frac{1}{5}$  of the total height, finely cellular, purplish umber-brown when mature; spores 3.5—4.9  $\mu$  in diam.; globose, smooth or finely warted; threads of capillitium to 5.6 (7.7)  $\mu$  thick, coloured, ramose.

Habitat: between moss or grass, mostly in dunes, more rarely in pastures, mostly on sand; often growing together with *Lycoperdon ericetorum* Pers.; solitary or in groups, rarely in small clusters; Aug. to Nov. (Febr.).

Specimens examined: Gr.: Groningen, 1856, *Stratingh* (GRO); Gld.: Nunspeet, 1898, *Beins* (L); Utr.: Blaauwkapel, 1841, *van der Sande Lacoste* (L); Doorn, 1869, *Oudemans* (L, GRO, U, NBV); Lage Vuursche, 1948, *Kleijn* (L); N.H.: Amsterdam, 1948, *Agsteribbe* (L); Bergen, 1948, *Heijbroek* (L); Bloemendaal, 1915 (L); Bussum, 1916, 1917, *van Overcem* a.o. (A); Haarlem, *Splitgerber* (L); 1914, *Cool* (L); Weesp, 1914, *van Overcem* (A); Z. H.: Dordrecht, 1945, 1949, *Kinstra* (L); Katwijk, 1835, *Molkenboer* (L); Jongmans (L); 1948, *Maas Geesteranus* 4361, 4362 (L); Loosduinen, 1888, *Destrée* (L); Oegstgeest, 1949, *Koster* 1625 (L); Wassenaar, *Molkenboer* (L); 1846, *Oudemans* (GRO, NBV); (Meyendel), 1948, *Perdeck* 177 (L); (Voorlinden), 1948, *Maas Geesteranus* 4341, 4343 (L); 1948, *Perdeck* 189 (L); Zeel.: Zwake, *van den Bosch* (L); N.B.: Bergen op Zoom, 1900, *La Fontijn* (GRO); Scheldedijken, 1901, *La Fontijn* (GRO).

Distribution: Europe (Denmark, England, Netherlands, Belgium, France, Germany, Austria, Hungary, Russia), Australia.

#### Remarks:

1. The first two give a clear description of this species was Hollós (1904, l.c.) and he applies to it the name *L. spadiceum*. Now in Persoon's herbarium there is only one sheet on which occurs the name *L. spadiceum* (no. HLB 910.256—1274). On the label, written by Persoon, one reads: "Gallia *Lycoperdon pyriforme* Batsch. Syn. Fung.? — *spadiceum*." The question-mark and "— *spadiceum*" are written in other ink and have apparently been added afterwards. So Persoon at first had taken it to be *L. pyriforme*, but later he began to doubt and thought that it was perhaps *L. spadiceum*. The specimens which are in bad condition are in my opinion *L. pyriforme*. We can only guess from his description and plate in J. de Bot., vol. 2, 1809, p. 18, tab. 1, fig. 5 what Persoon meant with *L. spadiceum*. But these are so little characteristic, that other species could have been meant as well (e.g. *L. ericetorum* Pers.). Now Hollós's

interpretation does not disagree with Persoon's description and plate and since the species is now generally known under this name, I propose to keep this name.

2. I agree with Hollós that *L. lividum* Pers., of which no authentic material exists, very probably is an immature *L. spadiceum*.

3. Judging from the description I think that to this species also belongs what is named *L. molle* Pers. by Trelease (Trans. Wisconsin Acad., vol. 7, 1889, p. 115), Morgan (J. Cincinnati Soc. Nat. Hist., vol. 14, 1891, p. 17), Hollós (Gastr. Ung., 1904, p. 112), Petri (Fl. Ital. Crypt., pars 1, fasc. 5, 1909, p. 19) and others.

4. Westendorp (Prodr. Fl. Bat., vol. 2, pars 4, 1866, p. 13) and Oudemans (Arch. Néerl., vol. 15, 1880, p. 373; Rév. Champ., 1892, p. 469; Cat. rais., 1904, p. 39) called this species *L. piriforme* Rüpp.

#### 4. BOVISTELLA Morg.

in J. Cincinnati Soc. Nat. Hist., vol. 14, 1892, p. 141.

Differs from *Lycoperdon* and *Calvatia* by the capillitium, which has the same structure as in *Bovista*; differs from *Bovista* by the possession of a subgleba; spores pedicellate; permanently attached to the substratum by a rooting base.

#### Remarks:

This genus was created by Morgan (l.c. 1892) as a monotypic genus, based on the species now called *Bovistella radicata* (Dur. et Mont.) Pat., which possesses a capillitium like *Bovista* and a subgleba. Lloyd (Myc. Notes, vol. 1, 1901, p. 85) was of the opinion that a sterile base was not a good character to separate it from *Bovista* and proposed to distinguish the two by their habit, *Bovista* being a genus in which the plant at maturity breaks away from the point of attachment, whereas in *Bovistella* the fungus remains attached as is the case in *Lycoperdon*. In a later paper (Myc. Notes, vol. 1, Lyc. Austr., 1905, p. 28) Lloyd emended *Bovistella* by including all species which show the combined characters of possessing a rooting base and having pedicellate spores, and in 1906 (Myc. Notes, vol. 2, p. 277) he goes so far as to include in the genus all species having a rooting base and either pedicellate spores or a capillitium of the *Bovista*-type. T. C. E. Fries (Ark. f. Bot., vol. 17, no. 9, 1921, p. 30) agreed with Lloyd's view of 1906, Cunningham (Proc. Linn. Soc. N. S. Wales, vol. 50, 1925, p. 367—368) with that of 1901. In 1942, however, Cunningham (Gastr. Austr., 1942, p. 142) rejected the genus on the grounds that some species examined by him could be placed under *Bovista* as well as under *Bovistella*, since specimens in the same collection may or may not possess a rooting base. According to him all species of *Bovistella* should be placed in the genus *Bovista*.

In my opinion this is not at all justified. If we take the genus in Morgan's original sense, that is including all species with a subgleba and a capillitium of the *Bovista*-type, there is, as far as I can see, not a single case which causes confusion with *Bovista*. In this sense all species, which Lloyd (l.c. 1906, p. 279) placed under his section "*Bovistella* true" belong to *Bovistella*, whereas his second and fourth section are identical with *Lycoperdon* and his third with *Bovista*.

Key to the species of *Bovistella*.

- 1a. Subgleba compact . . . . . 1\*. *B. paludosa*  
 1b. Subgleba cellular . . . . . 2. *B. radicata*

1\*. *Bovistella paludosa* (Lév.) Pat. in Lloyd, Myc. Notes, vol. 1, 1902, p. 88; vol. 2, 1906, p. 280; T. C. E. Fries in Bot. Not., 1933, p. 155; Favre in Bull. Soc. Myc. France, vol. 53, 1937, p. 293; Sandberg in Acta Phytogeogr. Suecica, vol. 13, 1940, p. 73 — *Bovista paludosa* Lév. in Ann. Sc. Nat., 3e ser., vol. 5, 1846, p. 163 — *Calvatia paludosa* (Lév.) de Toni in Sacc., Syll. Fung., vol. 7, 1888, p. 106.

This species which grows in swampy places, has not yet been found in the Netherlands. It is known from Sweden, England, Germany, France, Czechoslovakia, Yugoslavia (Montenegro), Italy. (cf. Lloyd, Myc. Notes, vol. 7, 1923, p. 1214).

2. *Bovistella radicata* (Dur. et Mont.) Pat. in Bull. Soc. Myc. France, vol. 15, 1889, p. 55; Hollós in Termész. Füzt., vol. 25, 1902, p. 99, 129; Lloyd, Myc. Notes, vol. 2, no. 22, 1906, p. 262, 280, tab. 87; Icon. in Bull. Soc. Myc. France, vol. 42, 1926, Atlas tab. 14; Kambly and Lee in Univ. of Iowa Stud., vol. 17, 1936, p. 151 — *Lycoperdon radicatum* Dur. et Mont. in Durieu, Flore d'Algérie, vol. 1, 1846—'49, p. 383; Montagne, Syll. Crypt., 1856, p. 287 (non W. et C.) — *Mycenastrum ohienae* Ell. et Morg. in J. Myc., vol. 1, 1885, p. 89 — *Bovistella ohienae* (Ell. et Morg.) Morg. in J. Cincinnati Soc. Nat. Hist., vol. 14, 1892, p. 141; Lloyd, Myc. Notes, vol. 2, no. 23, 1906, p. 279.

Fungus 2—3½ cm high, 2⅓—3½ cm wide (rarely exceeding 8 cm according to Kambly and Lee), height-width ratio from ⅔ to 1⅓, sessile or with an indistinct short stem, subglobose or depressed globose; exoperidium consisting of a white, uneven coat, which at maturity changes in more or less separate flat spiny scales with a dark top, and which after having fallen away, leave an indistinct reticulate structure, further down they have a more spiny character, eventually they disappear wholly on the upper part; endoperidium somewhat shiny, light brown; pore at first small, afterwards large, irregularly dehiscing; gleba umber-brown, incoherent, flocculose, without columella, at maturity disappearing through the aperture; subgleba definitely limited above, occupying ⅓ to ⅔ of the total height, cupshaped, cellular, at maturity umber-brown; spores globose to somewhat ovoid, 4.5—5.2 μ in diam., smooth, with a mostly 5.7—8.0 μ long pedicel; capillitium of the *Bovista*-type, main stem 4.2—5.6 μ thick — fig. 12, 13.

Habitat: on sheep tracks in heaths, September.

Specimens examined: Gld.: Otterlose heide, 1915, de Meyere (L).

Distribution: Europe (Netherlands, Germany, Spain), Africa (Tunis, Algiers), N. America. Pilát (Bull. Soc. Myc. France, vol. 53, 1937, p. 102) records the species also from Bulgary, but the description he gives makes me doubt, for he does not mention the cellular character of the subgleba.

## Remark:

Cool (Lev. Natuur, vol. 20, 1915, p. 104; Meded. Ned. Myc. Ver., vol. 7, 1916, p. 16) records the find of a dubious species, *Bovistella ammophila* (Lév.) Lloyd, in the dunes near Zandvoort.



From the superficial description and the figure I cannot decide which species it really was and, unfortunately, no material has been preserved.

Literature about *Bovistella ammophila*: Lévillé in Ann. Sc. Nat., 3e sér., vol. 9, 1848, p. 129; Lloyd, Myc. Notes, vol. 1, 1902, p. 88; vol. 2, 1906, p. 262, 281; vol. 7, 1923, p. 1214.

## 5. BOVISTA Pers.

Syn. Fung., 1801, p. 136.

Subglobose, soon loosening from the substratum; exoperidium membranaceous, nearly smooth, flaking off at maturity; endoperidium thin, opening by a mostly regular pore; gleba without columella; subgleba wanting; capillitium of little units, each consisting of a thick short main stem and slender ramose branches with tapering pointed ends; spores globose or ovoid, smooth or finely warted, mostly with a persistent pedicel.

### Key to the species of Bovista.

- 1a. Spores 6—10  $\mu$  in diam. . . . . 2. *B. macrospora*
- 1b. Spores 4—6  $\mu$  in diam.
  - 2a. Spores without a pedicel or with a very short one (about 1  $\mu$  long) 1\*. *B. pila*
  - 2b. Spores with a long pedicel (4.2—13.3  $\mu$  long).
    - 3a. Pedicels of the spores strongly curved, nearly circular . . . 3. *B. hungarica*
    - 3b. Pedicels of the spores straight or slightly curved.
      - 4a. Fungus 1.5—4 cm in diam.; endoperidium dull, lead-coloured, rarely brownish; mature gleba not purplish; spores mostly ovoid, with a 8.4—13.3  $\mu$  long pedicel . . . . . 5. *B. plumbea*
      - 4b. Fungus 3—5 cm in diam.; endoperidium somewhat shiny, dark brown, often purplish; mature gleba purplish; spores mostly globose, with a 4.2—8.0  $\mu$  long pedicel . . . . . 4. *B. nigrescens*

1\*. *Bovista pila* Berk. et Curt. in Grevillea, vol. 2, 1873, p. 49; Lloyd, Myc. Notes, vol. 1, 1902, p. 116; Hollós, Gastr. Ung., 1904, p. 122; Kambly and Lee in Univ. of Iowa Stud., vol. 17, 1936, p. 150.

Not found in the Netherlands, known from N. America and Europe (Hungary, one specimen, cf. Hollós, l.c.).

### 2. *Bovista macrospora* Perdeck, nov. spec.

Fungus 1,8 cm alta, 2,3 cm lata, subglobosa, subdepressa, peridium ubiquae lacunosa (in sicco), exoperidium flavo-brunneum, endoperidium cinereum, gleba flavo-olivacea, sporae 6,3—9,8  $\mu$  diam., globosae vel subglobosae, laeves, pedicellis 4,2—10,5  $\mu$  longis, apicem versus attenuatis; rami principales capillitii 14—25  $\mu$  crassi, pariete subtenue.

Fungus 1,8 cm high, 2,3 cm wide, globose, somewhat depressed; peridium lacunose; exoperidium yellow-brown; endoperidium greyish; pore not yet present; gleba yellowish-olivaceous; spores 6,3—9,8  $\mu$  in diam., globose or subglobose, smooth, with an 4,2—10,5  $\mu$  long, attenuated pedicel; capillitium of the *Bovista*-type, main stem 14—25  $\mu$  thick, wall thinnish.

Type specimen: Z.H.: near Dordrecht ("de Staart"), 30 Nov. 1945, Kinstra (L); young specimen.

### Remark:

Differs from all known *Bovista* species by the large spores. Related to *Bovista plumbea*, but differs also by the relatively shorter pedicels of the spores.

3. **Bovista hungarica** Holl. in Math. és Termész. Ertesito, vol. 19, 1901, p. 512; Gastr. Ung., 1904, p. 122; Killermann, Krypt. Forsch., vol. 1, 1926, p. 508; Feurig in Zs. f. Pilzkunde, vol. 12 (N. F.), 1928, p. 119.

Fungus 2.1—4.5 cm in diam., subglobose; exoperidium practically wanting in the specimens examined (Hollós does not give a description of it); endoperidium smooth, mostly somewhat silvery shiny and dirty grey, with darker, brown or purplish stains; pore irregularly dihiscent; gleba umber-brown, usually somewhat purplish; spores globose or subglobose, 4.9—5.6  $\mu$  diam., smooth or very finely warted, with a fairly long, very much curved (nearly circular) pedicel; capillitium with a 10—20  $\mu$  thick main stem.

Habitat: vegetable garden, according to Hollós on stubble-fields, Nov.—Jan., May, July; sometimes some specimens connected at the base.

Specimens examined: Gld.: Herwen, 1914, *Wakker* (L); Wilp, 1945, 1946, 1947, 1949, *van Heurn* (L).

Distribution: Europe (Hungary, Germany, Netherlands), very rare.

#### Remark:

The Dutch specimens fully agree with Hollós's description and figures. Very well characterised by the strongly curved pedicels of the spores.

4. **Bovista nigrescens** Pers., Syn. Fung., 1801, p. 136; in J. de Bot., vol. 2, 1809, p. 24; Fries, Syst. Myc., vol. 3, 1829, p. 23; Westendorp, Prodr. Fl. Bat., vol. 2, pars 4, 1866, p. 12; Oudemans, Arch. Néerl., vol. 15, 1880, p. 369; Rév. Champ., 1892, p. 471; Cat. rais., 1904, p. 40; Lloyd, Myc. Notes, vol. 1, 1902, p. 117; Hollós, Gastr. Ung., 1904, p. 124; Petri, Fl. Ital. Crypt., pars 1, fasc. 5, 1909, p. 61; Fries in Ark. f. Bot., vol. 17, no. 9, 1921, p. 32; Killermann, Krypt. Forsch., vol. 1, 1926, p. 508; Alexandri in Mem. Sect. Stiint. Acad. Rom. ser. 3, vol. 9, 1934, p. 49 — *Lycoperdon nigrescens* (Pers.) Vitt., Mon. Lye., 1842, p. 32; in Mem. Real. Acc. Sc. Torino, ser. 2, vol. 5, 1843, p. 176.

Fungus 3.2—5 cm in diam., mostly subglobose, sometimes kidney-shaped; exoperidium white or yellowish, smooth or somewhat rough, soon flaking off; endoperidium umber-brown or black-brown, rarely more yellow-brown, usually purplish and maculate, shiny, often with sharp transverse folds; pore 0.7—3.0 cm in diam., irregular; gleba young umber-brown, dark purplish brown when mature; spores 4.9—6.3  $\mu$  in diam., mostly globose, sometimes slightly ovoid, mostly finely, but distinctly warted (1000  $\times$ ), with a 4.2—8.0  $\mu$  long, straight or slightly curved pedicel; capillitium with a 12—20  $\mu$  thick main stem.

Habitat: grassy fields, March to October.

Specimens examined: Fr.: Oude Mirdummer Klif, 1928, *Zuiderzeeonderzoek* (L); Gld.: Ede, 1916, *de Meyere* (L); Hummelo, 1915, *de Meyere* (L); Wilp, 1946, 1947, 1948, 1949, *van Heurn* (L); N.H.: Beverwijk, 1915, *Vorstman* and *van Overeem* (A); Zeel.: Domburg, 1877, *Oudemans* (L); Walcheren, *van den Bosch* (L).

Distribution: Europe (Sweden, Denmark, England, Netherlands, Belgium, Germany, Austria, Russia, Czechoslovakia, Hungary, Rumania, Yugoslavia, Bulgaria, Italy).

#### Remarks:

1. Between *B. nigrescens* and *B. plumbea* I found the following differences:

	<i>B. nigrescens</i>	<i>B. plumbea</i>
1. size	3—5 cm	1,4—4 cm
2. colour of endoperidium	mostly dark brown, maculate	mostly grey, uniform
3. surface of endoperidium	shiny	dull
4. pore	0,7—3 cm in diam., irregular	0,3—1,0 cm in diam., regular
5. colour of mature gleba	purplish	olive or umber-brown
6. shape of spores	mostly globose	mostly ovoid
7. sculpture of spores	distinctly finely verrucose	nearly smooth
8. length of pedicel of spores	4,2—8,0 $\mu$	8,4—13,3 $\mu$

All these differences are mentioned in literature, except the seventh. Some of them seem to be inconstant. According to Vittadini, Morgan, Hollós and Lloyd (l.c.) the gleba of *B. plumbea* ultimately turns purplish. The length of the spore-pedicels which Lloyd and T. C. E. Fries consider to be a good character, is of no importance according to Hollós, Alexandri and Petri. Sometimes, the endoperidium of *B. plumbea* is not grey, but brown. This holds good for the type-specimen of this species (see under *B. plumbea*, remark 2). The other differences mentioned may all be observed in the types of these two species. Petri gives a difference in the branching of the capillitium threads, which I could not affirm. Another characteristic feature seems to be that, at least for the Netherlands, *B. nigrescens* has never been found in the winter months.

2. Killermann calls the small specimens forma *minor*, which seems to be superfluous.

3. The type of this species indicated by Lloyd is no. HLB 910.262—752 in the herb. Persoon.

5. *Bovista plumbea* Pers., Syn. Fung., 1801. p. 137; in J. de Bot., vol. 2, 1809, p. 24; Fries, Syst. Myc., vol. 3, 1829, p. 24; Westendorp, Prodr. Fl. Bat., vol. 2, pars 4, 1866, p. 13; Oudemans, Arch. Néerl., vol. 15, 1880, p. 369; Rév. Champ., 1892, p. 471; Cat. rais., 1904, p. 40; Lloyd, Myc. Notes, vol. 1, 1902, p. 115; Hollós, Gastr. Ung., 1904, p. 122; Petri, Fl. Ital. Crypt., pars 1, fasc. 5, 1909, p. 62; Killermann, Krypt. Forsch., vol. 1, 1926, p. 508; Alexandri in Mem. Sect. Stiint. Acad. Rom., ser. 3, vol. 9, 1934, p. 48; Kambly and Lee in Univ. of Iowa Stud., vol. 17, 1936, p. 15 — *Bovista tunicata* Fries, Syst. Myc., vol. 3, 1829, p. 25 — *Lycoperdon plumbeum* Vitt., Deser. Funghi Manger., 1835, p. 257; Mon. Lyc., 1842, p. 30; in Mem. Real. Acc. Sc. Torino, ser. 2, vol. 5, 1843, p. 174.

Fungus 1,7—4,0 cm in diam., subglobose; exoperidium dirty white or yellowish, nearly smooth or finely granular, flaking off at maturity; endoperidium light or dark lead-coloured, sometimes brown, dull, lightbrown at the margin of the pore; pore 3—10 mm in diam., mostly regular; gleba olive or umber-brown; spores 4,9—5,6  $\mu$  long, 4,2—4,9  $\mu$  broad, mostly slightly ovoid, occasionally globose, smooth or very indistinctly warty, with 8,4—13,3  $\mu$  long pedicels, which are straight or slightly curved; main stem of capillitium 10—17,5  $\mu$  thick.

Habitat: on grassy places, dunes, heath, August to April.



Specimens examined: Fr.: Workum, 1928, *Zuiderzeeonderzoek* (L); Ov.: Beuningen-Achterheide, 1948, *van Steenis* (L); Gld.: Beek, *Gevers Deynoot* (NBV); Ede, 1915, *de Meyere* (L); Epe, 1948, *van Kregten* (L); Putten, 1884, *Oudemans* (L); Weurt, 1847, *Abcleven* (L); Winterswijk, 1916, *van Luyk* (A); Utr.: Doorn, 1869, *Oudemans* (L, GRO, U); N.H.: Bussum, 1917, *van Overeem a.o.* (A); Crailoo, 1916, *Boedijn* (A); Huizen, 1948, *Heybroek* (L); Wieringen, 1856, *van der Sande Lacoste* (L); Z. H.: Den Briel, 1915, *Goethart* (L); Dordrecht, 1949, *Kinstra* (L); 's Gravenhage, 1948, *Perdeck* 184 (L); Koudekerk, 1943, *Fierët* (L); Kijkduin, *de Lint* (L); Leiden, *Dozy and Molkenboer* (L); Zeel.: Walcheren, 1877, *Oudemans* (L); N.B.: Bergen op Zoom, 1900, 1901, *La Fontijn* (GRO).

Distribution: Europe (Sweden, Denmark, England, Netherlands, France, Germany, Russia, Czechoslovakia, Hungary, Rumania, Yugoslavia, Bulgaria, Italy), N. America, Asia.

#### Remarks:

1. For differences from *B. nigrescens* see under that species (remark 1), where the occurrence of a purplish gleba of *B. plumbea* has already been mentioned.

2. I propose to consider no. HLB 910.262—767 in the herb. Persoon, the type specimen, for of the other sheets, on whose labels the name *plumbea* has been written by Persoon, one (no. HLB 910.262—758) shows specimens which exclusively are *B. nigrescens*, whereas on the other no. HLB 910.262—769) part of the specimens belong to that species. The type specimen has a dark brown endoperidium, which is a rare condition in this species.

3. Specimens with a brown endoperidium have been described as distinct species (*B. fulva* Mass., according to Lloyd, Myc. Notes, l.c., p. 116; *B. brunnea* Berk., according to Lloyd, Myc. Notes, vol. 1, Lye. Austr., 1905, p. 24; vol. 2, 1906, p. 263). I agree with Lloyd that this difference in colour is not sufficient to distinguish a separate species. As mentioned above, Persoon also called a brown specimen *B. plumbea* (the type specimen).

4. The ovoid form of the spores seems to vary considerably. (cf. Lloyd l.c., vol. 1, p. 115). Probably *B. ovalispora* Cke. et Mass. should be considered synonymous.

5. According to Lloyd (Myc. Notes, vol. 1, 1904, p. 171) who examined the type-specimen, *B. tunicata* Fr. is identical with *B. plumbea*.

6. Hollós (in Termész. Füzet., vol. 25, 1902, p. 100, 130; Gastr. Ung., 1904, p. 125) describes a species, called *B. tomentosa* (Vitt.) de Toni, which is distinguished from *B. plumbea* by the chestnut-brown endoperidium and the distinctly warted spores (already at 175  $\times$ ), from *B. nigrescens* by the small size (0.8—1.5 cm in diam.), the regular pore and the ovoid spores with a 12—18  $\mu$  long pedicel and from both by the tomentose exoperidium and the small spores (4—5  $\mu$  in diam.). Hollós states that it may easily be distinguished from both *B. plumbea* and *B. nigrescens* by the distinctly warted spores, but this cannot be maintained, since I found distinctly warted spores in *B. nigrescens* as well (type-specimen!). According to Hollós, *Bovistella dealbata* Lloyd (Myc. Notes, vol. 1, 1902, p. 86; vol. 2, 1906, p. 284) is identical to *B. tomentosa* as is *Bovista minor* Morg. (J. Cincinn. Soc. Nat. Hist., vol. 14, 1892, p. 147). According to Lloyd who examined the type-specimen *B. tomentosa* is a good species (Myc. Notes, vol. 2, 1908, p. 392; vol. 7, 1923, p. 1222). Petri

(Fl. Ital. Crypt., pars 1, fasc. 5, 1909, p. 63, 64) distinguishes the species also by its sparsely branched capillitium, which according to him has very thick walls, so that the lumen is nearly absent. He found the spores of Vittadini's type to be smooth and doubted whether Hollós's interpretation was correct.

The species is recorded from Europe (Germany, Hungary, Tirol, Italy) and N. America.

#### 6\*. MYCENASTRUM Desv.

in Ann. Sc. Nat. 2e sér., vol. 17, 1842, p. 143.

1\*. **Mycenastrum corium** (Guers.) Desv. in Ann. Sc. Nat., 2e sér., vol. 17, 1842, p. 147; Hollós in Termész. Füzt., vol. 25, 1902, p. 103, 132; Gastr. Ung., 1904, p. 126; Lloyd, Myc. Notes, vol. 1, 1902, p. 119; vol. 1, Lyc. Austr., 1905, p. 24; vol. 2, 1906, p. 290; T. C. E. Fries in Ark. f. Bot., vol. 17, no. 9, 1921, p. 34; Alexandri in Mem. Sect. Stiint. Acad. Rom., ser. 3, vol. 9, 1934, p. 51; Bottomley in Bothalia, vol. 4, 1948, p. 582.

Distribution: Europe (Sweden, Germany, Russia, France, Czechoslovakia, Rumania, Hungary, Yugoslavia, Italy), S. Africa, N. America, Australia, Asia. Not yet found in the Netherlands.

---

# THE GENUS POLYSIPHONIA IN THE NETHERLANDS

by

H. VELDKAMP

(Leiden).

The vegetative characters — especially those which are important for identification of the species — together with the distribution of the *Polysiphonia* species occurring in Netherland's waters were subject of the following study.

The material used consisted for the greater part of dried specimens, present in the following collections: Rijksherbarium (Leiden), herbarium Van Goor, Zoological Station (Den Helder), herbarium of the "Koninklijke Nederlandse Botanische Vereniging" (Rijksherbarium, Leiden) and the herbaria of the Universities of Amsterdam, Groningen and Utrecht.

As the collection of the Rijksherbarium at Leiden contains i. a. the herbarium of Kützing, it was possible to study the type-specimens of most of his species. Thanks to the Director of the Royal Botanic Gardens, Kew, the type specimens of the following species, present in the Kew Herbarium, could be studied as well: *Conferva brodiaei* Dillw., *Conferva denudata* Dillw..

The dimensions given in the description of the species are taken from dried specimens, which were soaked in fresh water. In some cases they may be smaller than those of living plants. However, it may be supposed, that the ratio between length and breadth of the articulations have nearly the same value as those in living specimens.

Of the previous taxonomical work on Netherland's *algae* may be mentioned: "Algae" in "Prodromus Florae Batavae", II, by R. van den Bosch (1853) and "Die Holländischen Meeresalgen", by A. van Goor (Verh. Kon. Akad. Wetensch. Amsterdam, Sect. 2, 23, 1923). For further work on this subject, the survey given by J. Th. Koster may be referred to (A review of the taxonomical and ecological studies on Netherlands' Algae, Recueil des Travaux botaniques Néerlandais, vol. 36, 1939).

I am pleased to thank all those who made this study possible. Especially to Dr Joséphine Th. Koster, the author is greatly indebted for helpful assistance and criticism.

## Key to the species of *Polysiphonia* in Netherlands waters.

- |                                                                  |                        |
|------------------------------------------------------------------|------------------------|
| 1. Pericentral cells 4 (with or without cortication) : . . . . . | 2                      |
| More than 4 pericentral cells . . . . .                          | 4                      |
| 2. Thallus without cortication . . . . .                         | 1. <i>P. urceolata</i> |
| Thallus corticated (sometimes only near the base) . . . . .      | 3                      |



3. Ultimate filaments fusiform, main branches very stout, cartilaginous, heavily corticated; pericentral cells in the main branches difficult to be distinguished . . . . . 2. *P. elongata*  
 Ultimate filaments equally thick, tapering to the top, main branches not very coarse; cortication sometimes restricted to the thallus base; when main branches also corticated, pericentral cells easy to be distinguished between the cortical cells . . . . . 3. *P. violacea*
4. Pericentral cells 5—8 . . . . . 5  
 More than 8 pericentral cells . . . . . 6
5. Pericentral cells 5—7, thallus ecorticated, or very slightly corticated near base . . . . . 4. *P. denudata*  
 Pericentral cells 6—8; main axis and principal branches heavily corticated . . . . . 5. *P. brodiaei*
6. Pericentral cells 12—24, branching dichotomous, all articulations shorter than their breadth; epiphytic nearly always on *Aecophyllum nodosum* . . . . . 6. *P. lanosa*  
 Not so . . . . . 7
7. Pericentral cells 8—13, more or less spirally curved; ultimate filaments fusiform; thallus ecorticated . . . . . 7. *P. nigra*  
 Pericentral cells 10—20, usually not spirally curved. Ultimate filaments tapering to the top; thallus ecorticated or corticated . . . . . 8
8. Pericentral cells 10—12; diameter of central cell  $\frac{1}{4}$ — $\frac{1}{5}$  of diameter of filament; thallus ecorticated . . . . . 8. *P. simulans*  
 Pericentral cells 12—20; diameter of central cell  $\frac{1}{3}$ — $\frac{2}{5}$  of diameter of filament; in large specimens main axis and principal branches in lower parts of thallus corticated . . . . . 9. *P. nigrescens*

1. *Polysiphonia urceolata* (Lightf.) Grev., Fl. Edinensis, 1824, p. 309; Harvey, Phyc. Brit., 1846—'51, t. 167; J. Ag., Sp., Gen., Ord. 2, 3, 1863, p. 970; Kütz., Sp. Alg., 1849, p. 824, Tab. Phyc., 13, 1863, t. 92; Hauck, Meeresalg., 1885, p. 221; De Toni, Syll. Alg., 4, 1889—1905, p. 875; Falkenberg, Rhodomet., 1901, p. 150; Preda, Fl. Ital. Crypt. 1, 1908, p. 231; Rosenvinge, Mar. Alg. of Denm., 1923—24, p. 406; Batten in Journ. Linn. Soc., 46, 1922—24, p. 289; Van Goor, Holl. Meeresalg., 1923, p. 29; Lakowitz, Algenfl. Ostsee, 1929, p. 338; Taylor, Mar. Alg. N. Am., 1937, p. 368; Kylin, Rhodoph. Schwed. W. Küste, 1944, p. 82 — *Conferva urceolata* Lightf. ex Dillwyn, Brit. Conf., 1809, p. 82, t. G — *Polysiphonia denticulata* Kütz., Sp. Alg., 1849, p. 824, Tab. Phyc., 13, 1863, t. 90.

Thallus bright reddish purple, to 10 cm high, forming dense tufts from creeping base; attached by rhizoids, formed by procumbent branches and lower parts of erect branches, branching pseudo-dichotomous to alternate. Central cell with smaller diameter than the 4 pericentral cells; the latter sometimes more or less spirally curved. Articulations near the base approximately as long as their breadth (50—150  $\mu$ ), in principal branches 2 to 4 or 5 times as long as their breadth (resp. 200—325  $\mu$  and 65—97  $\mu$ ), in ultimate branches to two times as broad as their length (e. g. 32  $\mu$  and 16  $\mu$ ) — fig. 2, 12.

Dutch records: Holwerd, July 1851, May 1852 (*Sprece*); Stavoren, Sept. 1845 (*Suringar*); dike Hoorn-Edam, Sept. 1854 (*Suringar*); Den Helder, Dec. 1909 (*Stomps*), June 1939 (*Vervoort*); Huisduinen, July 1948 (*Barkman*); Ymuiden, March 1949 (*Lucas*); Hoek van Holland, Febr. 1936 (*van Roon*), Febr. 1938 (*Koster, Vervoort*), Febr. 1948 (*Henneke*); Zierikzee, April 1939 (*Vervoort*); Walcheren, near Vere, Oct. 1940; Kanaal door Walcheren (canal), Aug., Sept., Oct. 1940; Canal Nieuwland—Arnemuiden, Aug. 1941, Dec. 1943; Nieuw en St. Joosland, June 1941; Zuid-Beveland, Bieselingse Ham, March 1941; Kanaal door Zuid-Beveland (canal), Sept. 1941 (all *Brakman*); Oosterschelde and Zandkreek, May 1840, March 1843, April 1845 (*van den Bosch*).

**Habitat:** Occurring on stones, woodwork, *Balanus*, *Laminaria*; near low water mark.

**Distribution:** Atlantic shores of Northern Europe (Batten) and N. America (Taylor), Adriatic (Hauck).

f. *roseola* (Ag.) J. Ag., Sp. Gen., Ord., 2, 3, 1863, p. 971; Rosenvinge, Mar. Alg. of Denm., 1923—1924, p. 411; Taylor, Mar. Alg. N. Amer., 1937, p. 369; Kylin, Rhodoph. Schwed. W. Küste, 1944, p. 82 — *Hutchinsia roseola* Ag., Sp. Alg., 1828, p. 92 — *Polysiphonia stricta* f. *gracilis* Kütz., Sp. Alg., 1849, p. 820.

Filaments slender, articulations mostly to 8—9 times as long as their breadth (e.g. diam. 130  $\mu$ , length 1087  $\mu$ ), sometimes still larger (12 times as long as their breadth, (e.g., diam. 115  $\mu$ , length 1420  $\mu$ ) — *fig. 1*.

Dutch records: Harlingen, 1904—1906 (*Kruizinga*); Texel, Oudeschild, near harbour, April 1949 (*Veldkamp*); Den Helder, May 1868 (coll. unknown), April 1898 (*Restink*), July 1899 (*Weevers*), May 1907 (*Postuma*), May 1931 (*Sobels*), Febr., March 1949 (*den Hartog*); April 1949 (*Swenmen*), June 1949 (*Stock*), Hoek van Holland, June 1948 (*Koster, Lucas*), Zierikzee, April 1939 (*Vervoort*), Zandkreek, May 1847 (*van den Bosch*).

**Habitat:** Growing probably always below low water mark.

**2. *Polysiphonia elongata*** (Huds.) Harv. ex Smith's Engl. Fl., 1833, p. 133; Harvey, Phyc. Brit., 1846—1851, t. 292, 293; Kütz. Sp. Alg., 1849, p. 828; Tab. Phyc., 14, 1864, t. 4; van den Bosch in Prodr., 2, 2, 1853, p. 171; Ag., Sp., Gen., Ord., 2, 3, 1863, p. 1004; Hauck, Meeresalg., 1885, p. 227; De Toni, Syll. Alg., 4, 1889—1905, p. 903; Falkenberg, Rhodomel., 1901, p. 126; Preda, Fl. Ital. Crypt. 1, 1908, p. 226; Batten in Journ. Linn. Soc., 46, 1922—1924, p. 297; Van Goor, Holl. Meeresalg., 1923, p. 32; Rosenvinge, Mar. Alg. of Denm., 1923—1924, p. 415; Lakowitz, Algenfl. Ostsee, 1929, p. 342; Taylor, Mar. Alg. N. Am., 1937, p. 367; Kylin, Rhodoph. Schwed. W. Küste, 1944, p. 83 — *Conferva elongata* Huds., Fl. Angl. 2, 1778, p. 599 — *P. arborescens* Kütz., Tab. Phyc., 14, 1864, t. 12 — *P. chalarophloea* Kütz., *ibid.*, t. 12 — *P. haematitis* Kütz., *ibid.*, t. 8 — *P. macroclonia* Kütz., *ibid.*, t. 13 — *P. stenocarpa* Kütz., *ibid.*, t. 11 — *P. trichodes* Kütz., *ibid.*, t. 10 — *P. robusta* Kütz., *ibid.*, t. 11 (not found in the herbarium Kützinger).

**Remarks:** It is not fully clear if *P. clavigera* Kütz. (Tab. Phyc., 14, 1863, t. 14) and *P. laxa* Kütz. (Tab. Phyc., 14, 1863, t. 3) can be regarded as synonyms of *P. elongata* (Huds.) Harv. The former has a rather slender habit, the main branches are not very coarse and the cortication is not as heavy as may be expected; as to the habit and cortication, the latter comes nearer to *P. elongata*, but the ultimate filaments, in a number of cases, do not distinctly taper at base and apex.

Thallus bright reddish-brown; to  $\pm$  20 cm high, attached by a disc; lower parts of thallus more or less bare; branching dichotomous to alternate. Main branches very coarse, the 4 pericentral cells surrounded by a cortex of considerable thickness. Whole thallus corticated, except to the end of ultimate filaments; the latter alternately branched, fusiform. Most articulations in the ultimate filaments shorter than their breadth — *fig. 10, 13*.

Dutch records: Terschelling, Bosplaat, Aug. 1949 (*Lucas*); Vlieland, near harbour, Aug. 1947, Vliehors, Aug. 1947 (*Lensink, Schijfsma*); Texel, near de Cocksdorp,

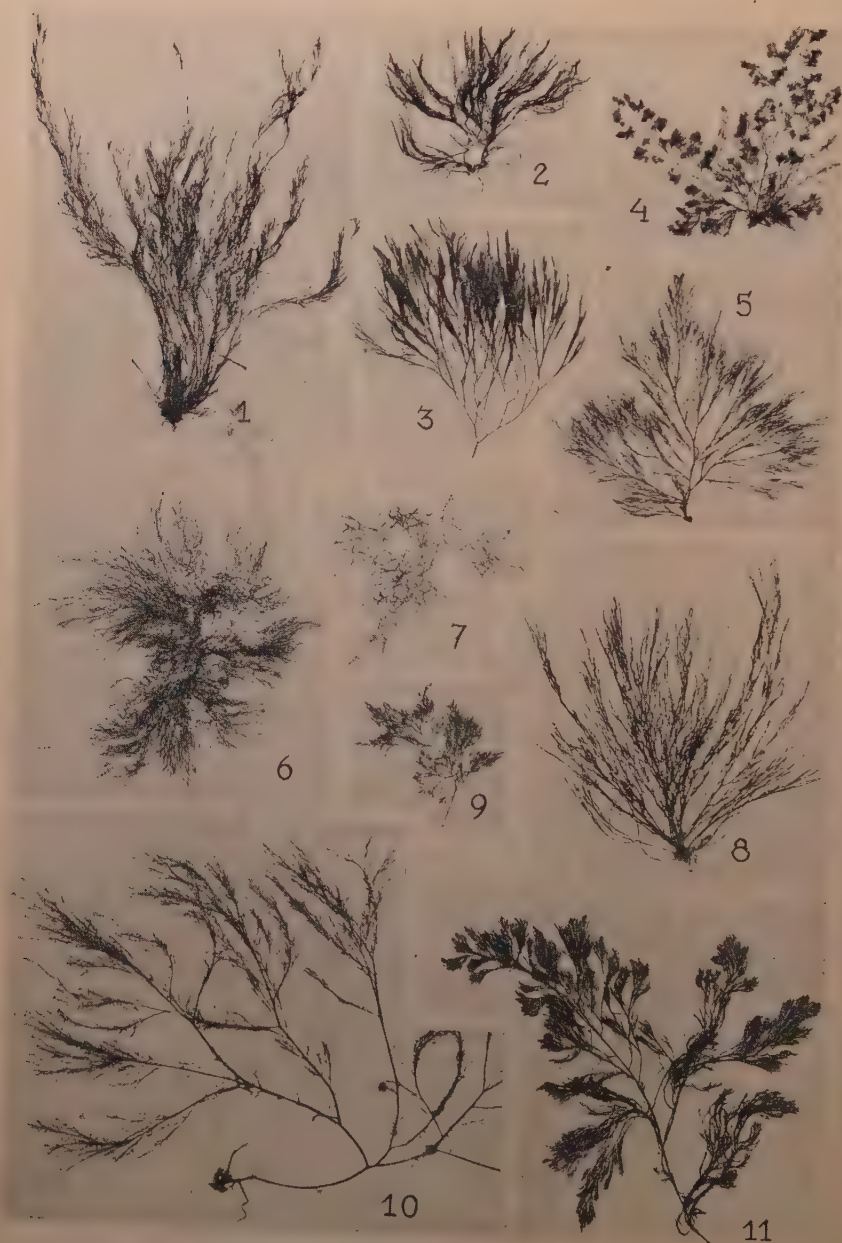


Fig. 1 — *Polysiphonia urceolata* (Lightf.) Grev. f. *roseola* (Ag.) J. Ag.; 2 — *P. urceolata* (Lightf.) Grev.; 3 — *P. denudata* (Dillw.) Kütz.; 4 — *P. brodiaei* (Dillw.) Grev.; 5 — *P. violacea* (Roth) Grev.; 6 — *P. violacea* (Roth) Grev. f. *tenuissima* (Huds.) Batters; 7 — *P. violacea* (Roth) Grev. f. *fibrillosa* (Dillw.) Aresch.; 8 — *P. nigra nigrescens* (Huds.) Grev.; 9 — *P. simulans* Harvey; 10 — *P. elongata* (Huds.) Harv.; 11 — *P.*



Aug. 1946 (*Meuwse*); Texel, N. of Oudeschild, drifting ashore, April 1949 (*Veldkamp*); Den Helder, Sept. 1885 (*Heinsius*), May 1919 (*van Goor*), April 1938 (*Zool. Station*); near Afsluitdijk, June 1939 (*Terroort*); Oosterschelde, March 1843 (*van den Bosch*), Ierseke, Sept. 1947 (*Korringa*).

**Habitat:** Mostly growing solitary, on stones and shells, often on a muddy soil, to be found as well on shallow coasts as on greater depth.

**Distribution:** Atlantic coasts of Europe (Batten, Börgesen, Hauck, Kylin, Rosenvinge, Lakowitz), Mediterranean and Adriatic (Hauck, Falkenberg), Atlantic coasts of United States from New York to Prince Edward Island (Taylor).

**3. *Polysiphonia violacea*** (Roth) Grev., emend. Rosenvinge, Mar. Alg. of Denm., 1923—1924, p. 422; Greville ex Smith, Engl. Fl., 1833, p. 332; Harvey, Phyc. Brit., 1846—1851, t. 209; Aresch., Phyc. Scand. Mar., 1850, p. 51; van den Bosch in Prodr., 2, 2, 1853, p. 171; J. Ag., Sp., Gen. Ord. 2, 3, 1863, p. 988; Kütz., Tab. Phyc., 13, 1863, t. 97, 98; Hauck, Meeresalg., 1885, p. 225; De Toni, Syll. Alg. 4, 1889—1905, p. 900; Falkenberg, Rhodomet., 1901, p. 115; Preda, Fl. Ital. Crypt., 1, 1908, p. 225; Batten, in Journ. Linn. Soc. 46, 1922—1924, p. 302; van Goor, Holl. Meeresalg., 1923, p. 30; Lakowitz, Algenfl. Ostsee, 1929, p. 340; Kylin, Rhodoph. Schwed. W. Küste, 1944, p. 83 — *Ceramium violaceum* Roth, Catal. Bot., 1797, 1, p. 150.

Thallus brownish-red, to 15 cm high, attached by a disc; branching alternate, main axis  $\pm 600 \mu$  thick, branched from the base; pericentral cells 4, surrounded by cortical cells in older parts of thallus. Articulations to about 5 times as long as their breadth (e.g. length  $1400 \mu$ , diam.  $275 \mu$ ). Ultimate filaments equally thick, tapering to the top — fig. 5, 14.

Dutch record: Goes, floating near harbour, Sept. 1942 (*Brakman*).

**Distribution:** Atlantic shores of Northern Europe, Baltic (Batten, Lakowitz).

f. *tenuissima* Aresch., Phyc. Scand., 1850, p. 54; Hauck, Meeresalg., 1885, p. 227; Batten in Journ. Linn. Soc. 46, 1922—1924, p. 302; Lakowitz, Algenfl. Ostsee, 1929, p. 341 — f. *tenuis* Rosenv., Mar. Alg. of Denm., 1923—1924, p. 422.

**Remarks:** *Polysiphonia roseola* Kütz., Tab. Phyc., 13, 1863, t. 80, is slightly corticated near the base and must be regarded as a synonym of *P. violacea* f. *tenuissima* Aresch. and not as a synonym of *P. urceolata* f. *roseola* (Ag.) J. Ag. Kützing regarded his *P. roseola* as a synonym of *Hutchinsia roseola* Ag., according to his remark, that is added to the specimen (Herb. Lugd. Bat. no. 941239 ..... 29), described in Tab. Phyc., 13, 1863, t. 80.

Thallus reddish brown, to  $\pm 7$  cm high, delicate; main axis thin ( $100$ — $250 \mu$ ). Cortication restricted to thallus base. Articulations to 8 times as long as their breadth (resp.  $100$ — $1300 \mu$  and  $50$ — $165 \mu$ ) — fig. 6.

Dutch records: Dike Hoorn-Edam, several specimens growing on *Fucus*, Sept. 1854 (*Suringar*); Den Helder, several epiphytic specimen, Aug. 1891 (*Moll*).

f. *fibrillosa* (Dillw.) Aresch., Phyc. Scand., 1850, p. 52; Rosenvinge, Mar. Alg. of Denm., 1923—1924, p. 422 — *Conferva fibrillosa* Dillwyn, Brit. Conf., 1809, p. 86 — *Polysiphonia fibrillosa* (Dillw.) Grev., ex Smith,

Engl. Fl., 1833, p. 334; Harvey, Phyc. Brit., 1846—1851, t. 302; J. Ag., Sp. Gen., Ord. 2, 3, 1863, p. 991; De Toni, Syll. Alg., 4, 1889—1905, p. 919; Batten, in Journ. Linn. Soc., 46, 1922—1924, p. 300; Lakowitz, Algenfl. Ostsee, 1, 929, p. 343; Taylor, Mar. Alg. N. Am., 1937, p. 364; Kylin, Rhodoph. Schwed. W. Küste, 1944, p. 83.

Thallus reddish brown (more yellowish in sunny places), to  $\pm 4$  cm high; branches spreading, clothed with short branchlets (the latter in the Netherlands specimens often nearly perpendicular to the former). Nearly whole thallus corticated, but only in lower part of main axis pericentral cells completely covered by cortical cells. Articulations to  $\pm 2.5$  diameter long (resp. diam. 90—150  $\mu$ , length 150—350  $\mu$ ) — *fig. 7*.

Dutch records: Den Helder, where several specimens drifted ashore on *Zostera*, July, 1899 (*Weewers*); Goes, Sept. 1942 (probably drifted ashore, *Brakman*).

Distribution: Atlantic shores of Europe, Baltic, Mediterranean (Batten), Long Island to Southern Massachusetts (Taylor).

**4. *Polysiphonia denudata*** (Dillw.) Kütz., Sp. Alg., 1849, p. 824, Tab. Phyc. 13, 1863, t. 90; Hoyt in Bull. U. S. Bur. Fisheries 36, 1920, p. 503; Williams in Am. Journ. of Bot. 35, 1948, p. 694 — *Conferva denudata* Dillwyn, Brit. Conf., 1809, p. 85, t. G — *Hutchinsia denudata* Agardh, Sp. Alg. 2, 1828, p. 73 — *Hutchinsia variegata* Agardh, Syst. Alg., 1824, p. 153, Sp. Alg. 2, 1828, p. 81 — *Polysiphonia variegata* (Ag.) Zanardini, Syn., 1841, p. 60; J. Ag., Alg. Med., 1842, p. 129, Sp. Gen., Ord., 2, 3, 1863, p. 1030; Kütz., Sp. Alg., 1849, p. 821, Tab. Phyc. 13, 1863, t. 81; Harvey, Phyc. Brit., 1846—1851, t. 155, van den Bosch in Prodr., 2, 2, 1853, p. 172; Bornet et Thuret, Etud. Phyc., 1878, t. 42; Hauck, Meeresalg., 1885, p. 236; De Toni, Syll. Alg. 4, 1889—1905, p. 922; Falkenberg, Rhodomet., 1901, p. 119; Preda, Fl. Ital. Crypt., 1, 1908, p. 218; Batten in Journ. Linn. Soc., 46, 1922—1924, p. 271; van Goor, Holl. Meeresalg., 1923, p. 32; Taylor, Mar. Alg. N. Am., 1937, p. 370 — *Polysiphonia leptura* Kütz., Sp. Alg., 1849, p. 824, Tab. Phyc., 13, 1863, t. 89 — *Polysiphonia vidovichii* Menegh. ex Kütz., Sp. Alg., 1849, p. 816, Tab. Phyc., 13, 1863, t. 68.

Remarks: Not to be regarded as synonyms of *P. denudata* (Dillw.) Kütz. are: *P. aurantiaca* Kütz., Tab. Phyc., 13, t. 73, which has 4 pericentral cells; *P. gonatophora* Kütz., which also has 4 pericentral cells; so Kützing's statement in Phyc. gener., 1843, p. 426 is right, his statement in Sp. Alg., 1849, p. 826, is wrong; *P. lusitanica* Kütz., Tab. Phyc., 13, 1863, t. 74, has the same structure as *P. denudata* (Dillw.) Kütz., but a quite different habit.

Thallus, purple-reddish brown to 15 cm high, attached by a disc, branched from the base; branching more or less dichotomous; lower branches widely divergent, upper branches more erect. Pericentral cells 5, 6 or 7 (mostly 6); thallus ecorticated or very slightly corticated near the base. Articulations near the base and in the ultimate branches shorter than their breadth (resp. diam.  $\pm 290$   $\mu$ , length  $\pm 260$   $\mu$  and diam.  $\pm 110$   $\mu$ , length  $\pm 95$   $\mu$ ), in the principal branches mostly to about three times as long as broad (e.g. length 480  $\mu$ , breadth 150  $\mu$ ). Sometimes still longer,  $\pm 5$  times as long as their breadth (e.g. length 550  $\mu$ , breadth 100  $\mu$ ) — *fig. 3*.

Dutch records: Den Helder, numerous specimens were found floating near Nieuwediep, Oct. 1947, Nov. 1947 (*Kristensen*); Schouwen, dike of the south coast, Aug. 1939 (*Bakker*), Aug. 1948 (*Stam*); Walcheren, Arnemuidens kanaal, Aug. 1947; Canal Nieuwland—Arnemuiden, Aug. 1940, Aug. 1941, Aug. 1947 (both *Brakman*); Zuid-Beveland, Goes, Nov. 1846 (*van den Bosch*); Kützing was wrong in regarding these specimens as *P. Richardsoni* Hook.); Goes, Sept. 1947; Kanaal door Zuid-Beveland (canal), Sept. 1941 (both *Brakman*); Ierseke, Sept. 1947 (*Korringa*).

Habitat: On stones, oyster-shells and on *Zostera*. According to Falkenberg, occurring only in polluted waters.

Distribution: Great Britain, Atlantic shores of Belgium, France and Spain, Mediterranean and Adriatic (Batten). Atlantic shores of United States, from Florida to Prince Edward Island (Taylor).

5. *Polysiphonia brodiaei* (Dillw.) Grev. ex Smith, Engl. Fl., 1833, p. 328; Harvey, Phyc. Brit., 1846—1851, t. 95; Kütz., Sp. Alg., 1849, p. 827, Tab. Phyc., 14, 1864, t. 1; J. Ag., Sp., Gen. Ord., 2, 3, 1863, p. 993; Hauck, Meeresalg., 1885, p. 237; De Toni, Syll. Alg. 4, 1889, 1905, p. 947; Preda, Fl. Ital. Crypt., 1, 1908, p. 213; Rosenvinge, Mar. Alg. of Denmark, 1923—1924, p. 430; Batten in Journ. Linn. Soc., 46, 1922—1924, p. 303; Kylin, Rhodoph. Schwed. W. Küste, 1944, p. 84 — *Conferva brodiaei* Dillwyn, Brit. Conf., 1809, t. 107.

Remarks: Not to be regarded as a synonym of *P. brodiaei* (Dillw.) Grev. are *P. callitricha* Kütz., Tab. Phyc., 14, 1864, t. 2, *P. polycarpa* Kütz., Tab. Phyc., 14, 1864, t. 2, *P. polychotoma* Kütz., Sp. Alg., 1849, p. 828; they all have only 4 pericentral cells.

Thallus reddish-brown, to 15 cm high, attached by rhizoids. Main axis (1—1.5 mm thick) and principal branches heavily corticated; 6—8 pericentral cells (mostly 7). Branching irregular. Ramuli forming distinct tufts. Articulations in the ultimate branches mostly broader than their length — *fig. 4*.

Dutch records: Ierseke, June 1937, on oyster-shell, near low water mark (*Korringa*).

Distribution: England and Atlantic shores of Europe, from Scandinavia as far south as France (Batten, Kylin).

6. *Polysiphonia lanosa* (L.) Tandy in Journ. of Bot., 31, 1931, p. 225; Taylor, Mar. Alg. N. Am., 1937, p. 373 — *Fucus lanosus* L., Syst. Nat., ed. 12, 1767, p. 718 — *Polysiphonia fastigiata* Grev., Fl. Edinensis, 1824, p. 308; Harvey, Phyc. Brit., 1846—1851, t. 299; Kütz., Sp. Alg., 1849, p. 809, Tab. Phyc., 13, 1863, t. 44; van den Bosch in Prodr., 2, 2, 1853, p. 173; J. Ag., Sp., Gen. Ord., 2, 3, 1863, p. 1029; Hauck, Meeresalg., 1885, p. 245; De Toni, Syll. Alg. 4, 1889—1905, p. 945; Gibson in Journ. of Bot., 1891, p. 129; Falkenberg, Rhodomel. 1901, p. 149; Batten in Journ. Linn. Soc. 46, 1922—1924, p. 290; van Goor, Holl. Meeresalg., 1923, p. 34.

Thallus dark brownish purple, to 5 cm high, attached by rhizoids, penetrating the tissue of the host; branching dichotomous. Pericentral cells 12—24 (often more than 20). All articulations shorter than their breadth. Central cell with thick wall, except in the middle; when focussing on the surface of the filaments the cell-contents may be seen as dark nodules in the wide lumen in the middle of the cell. Every pericentral cell is connected with this central nodulus by a thin, canal-like pit. A





Fig. 12 — *Polysiphonia urceolata* (Lightf.) Grev., transverse section of thallus; 13 — *P. elongata* (Huds.) Harv., ultimate filament, 50 ×; 14 — *P. violacea* (Roth) Grev., ultimate filament, 50 ×; 15 — *P. nigrescens* (Huds.) Grev., transverse section of thallus.

ring-shaped intercellular space often to be seen between central- and pericentral cells at the junction of two articulations.

Dutch records: Delfzijl, April 1885 (*Weber*); Den Helder, May 1895 (*Moll*), April 1908 (*Honing*), April 1916 (*Haringa*), June 1933 (*Zanerveld*), April 1935, Dec. 1936, April 1939, June 1939 (*Zool. Station*); Schouwen, Serooskerke, April 1939, April 1941 (*Piergever*); Noord-Beveland, Kortgene, Febr. 1941 (*Brakman*); Zuid-Beveland, Sept. 1841 (*van den Bosch*); Kattendijke, March 1941 (*Brakman*); Walcheren, Vere, Oct. 1940 (*Brakman*); Arnemuiden, Nov. 1940 (*Brakman*).

Habitat: On *Ascophyllum nodosum*; very rarely on other *Fucales*.

Distribution: England (Batten), Atlantic shores of Belgium, France and Spain (Chalon, 1905), Faeröes (Börgesen). Not to be found in the Baltic (Börgesen in Tandy 1931). Atlantic coasts of N. America, from New Jersey to Prince Edward Island (Taylor).

7. *Polysiphonia nigra* (Huds.) Batters, Cat. Brit. Mar. Alg., 1902, p. 81, Taylor, Mar. Alg. N. Am., 1937, p. 371 — *Conferva nigra* Hudson, Fl. Angl., 1798, p. 595 — *Polysiphonia atrorubescens* (Dillw.) Grev., Fl. Edinensis, 1824, p. 308; Harvey, Phyc. Brit., 1849, t. 172; Kütz., Sp. Alg., 1849, p. 821, Tab. Phyc., 13, 1863, t. 82; van den Bosch in Prodr., 2, 2, 1853, p. 171; J. Ag., Sp. Gen. Ord., 2, 3, 1863, p. 1035; Hauck, Meeresalg., 1885, p. 243; De Toni, Syll. Alg. 4, 1889—1905, p. 938; Rosenvinge, Mar. Alg. of Denm., 1923—1924, p. 435; Batten in Journ. Linn. Soc. 46, 1922—1924, p. 289.

Thallus reddish brown to nearly black, to  $\pm 15$  cm high, attached by rhizoids; main axis and principal branches pseudodichotomously branched. Ultimate filaments fusiform. Pericentral cells 8—13, more or less spirally curved, except to the end of ultimate filaments; thallus ecarticated. Articulations in main branches to 3—4 diameter long (diam. 80—250  $\mu$ , length 110—890  $\mu$ ), sometimes still larger, about 5—6 times as long as broad (e.g. diam. 210  $\mu$ , length 1140  $\mu$ ); becoming shorter in ultimate branches — fig. 8.

Dutch records: Den Helder, May 1869 (coll. unknown), Febr. 1919 (drifted ashore (*van Goor*)), May 1919 (*van Goor*), Oosterschelde, March 1843, April 1844 (*van den Bosch*).

Distribution: Atlantic coasts of Europe (Batten) and N. America from long Island to Northern Massachusetts (Taylor).

8. *Polysiphonia simulans* Harvey, Man. Brit. Mar. Alg., Ed. 2, 1849, p. 89; J. Ag., Sp. Gen. Ord., 2, 3, 1863, p. 1051; De Toni, Syll. Alg. 4, 1889—1905, p. 935; Batten, in Journ. Linn. Soc. 46, 1922—1924, p. 295.

Thallus brownish-red, to 5 cm high, bearing regularly inserted pyramid-shaped tufts; branching pseudo-dichotomous to alternate. Ultimate filaments tapering to the top. Pericentral cells 10—12; diameter of central cell  $\frac{1}{4}$ — $\frac{1}{5}$  of filament diameter; thallus ecarticated. Articulations in main axis to about 5 diameters long (e.g. diam. 275  $\mu$ , length 1300  $\mu$ ), in main branches to about twice as long as their breadth (e.g. diam. 162  $\mu$ , length 324  $\mu$ ); in ultimate filaments length of articulations equal to their breadth (e.g. 80  $\mu \times 80\mu$ ), or shorter than their breadth (near the top) — fig. 9.

Dutch record: Vlieland, May 1891 (*Weber-van Bosse*). Although the articulations of this specimen are longer than those described by Harvey, it seems to be probable that it belongs to this species.

Distribution: England (Batten) and shores of the Channel (Chalon, 1905).

9. *Polysiphonia nigrescens* (Huds.) Grev., ex Smith, Engl. Fl., 1833, p. 332; Harvey, Phyc. Brit., 1846—1851, t. 277; Kütz., Sp. Alg., 1849, p. 813, Tab. Phyc., 13, 1863, t. 56; van den Bosch in Prodr., 2, 2, 1853, p. 172 (incl. syn.); J. Ag., Sp., Gen., Ord., 2, 3, 1863, p. 1057; Hauck, Meeresalg., 1885, p. 244; De Toni, Syll. Alg. 4, 1889—1905, p. 940; Falkenberg, Rhodomet., 1901, p. 129; Rosenvinge, Mar. Alg. of Denm., 1923—1924, p. 439; Batten in Journ. Linn. Soc., 46, 1922—1924, p. 306; van Goor, Holl. Meeresalg., 1923, p. 33; Lakowitz, Algenfl. Ostsee, 1929, p. 344; Taylor, Mar. Alg., N. Am., 1937, p. 371, Kylin, Rhodoph. Schwed. W. Küste, 1944, p. 84 — *Conferva nigrescens* Hudson, Fl. Angl. p. 602 (not seen) — *Polysiphonia dichoccephala* Kütz., Tab. Phyc., 13, 1863, t. 53 — *Polysiphonia lophura* Kütz., *ibid.*, t. 52 — *Polysiphonia regularis* Kütz., *ibid.*, t. 51 — *Polysiphonia sentosa* Kütz., *ibid.*, t. 51 — *Polysiphonia violascens* Kütz., *ibid.*, t. 54.

Thallus purple to black, to 25 cm high, attached by rhizoids; base of main axis disc-like. Branching alternate (sometimes very regularly); tufts sometimes more or less pyramid-shaped, often more or less corymbose. Ultimate filaments tapering to the top. Pericentral cells sometimes slightly spirally curved, only in large plants surrounded by cortical cells near thallus base. Pericentral cells (in older parts of thallus more numerous than in younger ones) 12—20; diameter of central cell  $\frac{1}{3}$ — $\frac{2}{5}$  of filament diameter. Articulations about as long as broad near thallus base, becoming longer in upper parts, (to 5 diameters long; e. g. diameter  $\pm$  300  $\mu$ , length  $\pm$  1500  $\mu$ ); articulations near the end of ultimate filaments shorter than their breadth — *fig. 11, 15.*

Dutch records: Dijkshoek, May 1852; Holwerd, May 1852 (both *Spree*); Terschelling, S. of Midland, July 1947 (*Koster*); Oosterend, June 1948 (*Lucas*); West Terschelling, harbour, Aug. 1949 (*Lucas*); Texel, Nov. 1884 (*Weber—van Bosse*); Texel, harbour Oudeschild, April 1949 (*Veldkamp*); Den Helder, June 1886 (*Weber—van Bosse*), Aug. 1897 (coll. unknown), Aug. 1897 (*Bonnema*), April 1898 (*Resink*), July 1899 (*Weevers*), July 1904 (*Geerts*), Nov. 1909 (*Stomps*), May 1930 (*Lanjouw*), May 1931 (*Sobels*), June 1939 (*Vervoort*), July 1939 (*Koster*), Dec. 1948 (*den Hartog*), June 1948 (*Lucas*), Febr. 1949 (*Swennen, den Hartog*), March 1949 (*den Hartog*); Medemblik, Aug. 1905 (coll. unknown); Enkhuizen, July 1905 (coll. unknown); Hoorn-Edam, Sept. 1854 (*Suringar*); Monnikendam, July 1905 (coll. unknown); IJmuiden, June 1884 (*Weber—van Bosse*); Hoek van Holland, Febr. 1938 (*Vervoort*), July 1947 (*Koster*), Oct. 1949 (*Lucas*); Schouwen, Scharendijke, April 1939; Westerschouwen, April 1939, Zierikzee, April 1939 (*Vervoort*); Burgsluis, June 1949 (*Hoogland*); Bergen op Zoom, Nov. 1943 (*Maas Geesteranus*); Oosterschelde, March 1843, April 1844, May 1845, May 1847; Zandkreek, April 1842, May 1844, June 1845; Zuid-Beveland, Iersekenhamme, Sept. 1841 (all *van den Bosch*); Kanaal door Zuid-Beveland (canal), Sept. 1941, Dec. 1941 (*Brakman*).

Though most of the Dutch material seems to belong to *f. fucoides* (Huds.) Harv., it is evident that *f. flaccida* Aresch. and *f. affinis* (Moore) Harv. are among the specimens collected by Spree (Holwerd, 1852).

Distribution: Atlantic shores of Europe (Batten) and of N. America from South Carolina to Prince Edward Island (Taylor).



# THE ALGAE TRANSPORTED ON DRIFTING OBJECTS AND WASHED ASHORE ON THE NETHERLANDS' COAST

by

J. A. W. LUCAS

(Leiden).

(Issued 3. IV. 1950)

---

## Introduction.

Little attention has been paid till now to the algae, transported to the Netherlands coast on drifting objects. About a century ago T. D. Vrijdag Zijnen and G. Bisschop (near Scheveningen,  $\pm$  1845), and L. H. Buse (between Wijk aan Zee and Zandvoort,  $\pm$  1840—1847) were the first to pay attention to this subject. The material collected, especially that by the first two investigators, is mentioned in the *Prodromus Fl. Bat.* (1853). The book of Van Goor (1923) contains a chapter on these algae, in which, however, only few new observations occur. The author is much indebted to Dr Joséphine Th. Koster for her kind help, as well as to Dr S. J. v. Ooststroom. The material, collected by Vrijdag Zijnen, Bisschop and Buse is almost completely present in the collections of the 'Rijksherbarium' and the 'Koninklijke Nederlandse Botanische Vereniging', Leiden. The material, collected during the last few years has for the greater part been brought together by the present author, and furthermore especially by K. Swennen (Den Helder), J. Stock (Amsterdam), A. Mulder (Haarlem) and P. Leenhouts (Scheveningen). This material belongs to the collection of the Rijksherbarium, Leiden, but most of it is, for the time being, put under the charge of the "Comité ter Bestudering van de Nederlandse Mariene Flora en Fauna" ("Committee on the Netherlands' Marine Flora and Fauna") and temporarily preserved in "Het Filiaal", Leiden.

## Origin of the material.

The detached algae and the floating bunches of cork, as used on French fishing boats, are transported passively, so that a matter of first importance is to know the occurrence and direction of the sea currents. Carruthers (1925) has found that the Gulf stream splits into two branches, S.W. of Ireland. The smaller southern branch reaches the North Sea through the Channel and the Strait of Dover; the large one flows around Scotland and the Faroes, bends to the South and joins the southern branch, after which they flow on to the German Bight and the Danish Coast. The place of the junction depends on the direction of the wind, and is

situated near the Frisian islands. As the algae are mostly washed ashore during gales from the S.W., it is probable that most of them are of more southern origin, though also material from the North can be found washed ashore, especially on the Frisian islands.

From the investigations by A. E. H. M. Bloklander and J. Brouwer (1946—1947) and from oral communications of Bloklander and L. B. Holt-huis it appears that among the transported animals several are of more southern origin: *Cantharidus exasperatus*, *Diodora apertura*, *Gibbula umbilicalis*, *Lutraria magna*, *Paphia aurea*, *Tricolia pullus picta*, *Trivia monacha* (Mollusca), *Stephanosella biaperta* (Bryozoa), *Balanus perforatus*, *Balanus tintinnabulum*, *Lepas pectinata* (Cirripedia), *Naesa bidentata* (Isopoda), *Apseudes talpa* (Tanaidaceae) and *Eunice harrasii* (Polychaeta).

According to Van Goor (1923) the following algae are of more southern origin: *Cystoseira fibrosa*, *Dasya pedicellata* (*D. elegans*), *Gastroclonium ovale*, *Grateloupia filicina*, *Padina pavonia* and *Sargassum natans*. Furthermore the algae *Antithamnionella sarniensis*, *Falkenbergia hillebrandii*, *Gastroclonium clavatum* and *Acrosorium reptans* also originate from more southern regions. Only few specimens can with certainty be considered as being of more northern origin, e.g. the molluscs *Malletia obtusa* and *Astarte montagui* and the alga *Ptilota plumosa*. This agrees with the views of Van Goor and of Bloklander and Brouwer.

In most cases this place of origin is the Channel, which can be concluded from the great frequency of some algae, which do not occur in detached state north of the Channel, as *Antithamnionella sarniensis*, *Falkenbergia hillebrandii* and *Gastroclonium ovale*. Also the Cirripede *Balanus perforatus* is very common on drifting objects.

We now have to consider the question, whether the material comes from a greater distance than from the Channel. This has certainly to be assumed for *Sargassum natans*, but for other material it is doubtful. Even the following three species, not mentioned for the English coast, but for still more southern regions, probably occur in the Channel:

1. *Dasya pedicellata* (Ag.) Ag. A specimen of this species has been found in 1844 on *Himanthalia*, washed ashore at Zandvoort. In 1948 a detached specimen of *Dasya pedicellata*, showing a great number of tetraspores, was washed ashore on the beach near Hellevoetsluis. The good condition of this specimen suggests, that it has not been transported over a great distance, and that it might even have grown on the Netherlands coast. This suggests the possibility that this species is a native of the Channel coasts.

2. *Falkenbergia hillebrandii* (Born.) Falkenb. As this species occurs practically in all adventitious material, it is probable that its origin is more or less near to the Netherlands coast. Moreover the species has been found on the same floating object as *Antithamnionella sarniensis*.

3. *Gastroclonium clavatum* (Roth) Ardis. This species was found on a piece of cork, which was overgrown with the species *Antithamnionella sarniensis*, characteristic for the Channel; from this it may be concluded, that the above-mentioned *Gastroclonium* originates from the Channel. Also the animals, drifted ashore on the same day, indicate an origin from the Channel.

IJzerman (1937) has studied the small pieces of rock, to which algae were found attached and which were washed ashore between Zandvoort and Katwijk. The origin of these rocks proved to be the coast of Normandy and the South Coast of England.

### Substratum.

Often algae are washed ashore, epiphytic on large brown seaweeds, such as: *Ascophyllum nodosum* (L.) Le Jol.; *Chorda filum* (L.) Lamour.; *Fucus ceranoides* L.; *Fucus serratus* L.; *Fucus spiralis* L.; *Fucus vesiculosus* L.; *Fucus serratus* L.  $\times$  *Fucus vesiculosus* L.; *Halidrys siliquosa* (L.) Lyngb.; *Himanthalia lorea* (L.) Lyngb.; *Laminaria digitata* (L.) Lamour.; *Laminaria saccharina* (L.) Lamour.; *Saccorhiza bulbosa* (Huds.) de la Pyl.; *Sargassum natans* (L.) Borg. Especially the stipes of *Himanthalia* are very rich in epiphytes; as many as 71 different species have been found on those parts.

Another rich substratum is formed by bunches of cork, as are in use on board of French fishing boats, and also floating pieces of wood (e.g. beams). Also on smaller objects the algae can be transported, as there are cinders, egg capsules of rays and skates, clumps of *Buccinum* eggs, inner shells of *Sepia*, etc.

### Condition of the material.

After having been drifted ashore, the material is mostly in a very good condition, and often apparently still alive. It is striking, that most plants, even when they are fertile, are of a very small size. Fruetification of these plants sometimes occurs at other periods than is mentioned for the plants in their normal habitat.

### Duration of the transport.

This can be estimated at one or two months, as may be derived from the following observation. On 19—21 September 1948 algae were washed ashore on the coast of Zuid-Holland in a great number, but in a smaller number on that of Noord-Holland. They were probably detached by a gale blowing from the S.W. on the fifth of August. After the gale of 19—21 September material was washed ashore on the 24th of October and *Himanthalia* especially South of Noordwijk. On the 24th of November much material was east on the dike at Den Helder. All this material probably hails from the same source, as results from the study of the flora as well as the fauna.

It is an interesting fact that the bunches of cork, the beams, etc. are transported more quickly than the drifting algae. On the 24th of October e.g. the algae were mainly washed ashore south of Noordwijk, while the greater part of the cork, beams, etc. were found north of Noordwijk.

Egg capsules of rays and skates are washed ashore usually about one or two weeks after the algae.



## List of the species drifted ashore.

This list contains the names of 171 species; 65 of them have not been previously recorded from the Netherlands coasts; these have been marked with an asterisk.

To the material which has not been studied by the author, either (Van Goor) or (Prodr.) has been added.

The phorophyta or substrata are mentioned as far as these data were available.

## CYANOPHYCEAE.

*Calothrix confervicola* Ag. — Noordwijkerhout-Noordwijk, 20-9-1948, Lucas 127, *Chorda filum*.

\**Hydrocoleum lyngbyaceum* Kütz. — Kijkduin-Terheiden, 21-11-1948, Lucas 188, *Himanthalia lorea*.

*Lyngbya semiplena* Ag. — Noordwijk-Katwijk, 15-11-1949, Lucas 494, bunch of cork.

\**Oscillatoria nigro-viridia* Thwaites — Scheveningen, 30-11-1947, Lucas 279, *Himanthalia lorea*.

\**Oscillatoria planctonica* Wolonszynska — Noordwijk-Katwijk, 14-12-1947, Lucas 325, *Himanthalia lorea*; Katwijk-Wassenaarse Slag, 10-12-1947, Lucas 332, *Laomedea geniculata*.

## CHLOROPHYCEAE.

*Bryopsis plumosa* (Huds.) Ag. — Syn. *B. hypnoides* Lamour. — Scheveningen, 30-11-1947, Lucas 275, *Himanthalia lorea*.

*Cladophora arcta* (Dillw.) Kütz. — Noordwijkerhout-Noordwijk, 5-11-1948, Lucas 246, *Himanthalia lorea*.

*Cladophora flexuosa* (Griff.) Harv. — Zandvoort, I-1852, *Buse*, Noordwijkerhout-Noordwijk, 5-11-1948, Lucas 145, *Himanthalia lorea*; Katwijk, 11-3-1949, cork.

*Cladophora fracta* (Dillw.) Kütz. — Den Helder, 3-1-1950, *C. den Hartog*, wood.

*Cladophora lanosa* (Roth) Kütz. — Scheveningen, *Vrijdag Zijnen*, *Fucus vesiculosus*.

\**Cladophora prolifera* (Roth) Kütz. — Noordwijkerhout-Noordwijk, 5-11-1948, Lucas 147, *Himanthalia lorea*.

*Cladophora refracta* (Roth) Kütz. — Scheveningen, 23-12-1947, *Leenhouts* 160, cork.

*Cladophora rupestris* (L.) Kütz. — Zandvoort-Katwijk, 11-3-1949, Lucas 89, egg capsule of *Raja clavata*; Noordwijk, 12-12-1948, Lucas 149, *Ascophyllum nodosum*; *ibid.*, 13-11-1949, Lucas 455, egg capsule of *Raja clavata*; Noordwijk-Katwijk, 15-11-1949, Lucas 521, egg-capsule of *Raja clavata*; Kijkduin-Terheiden, 21-11-1948, Lucas 70 and Lucas 213, *Himanthalia lorea*.

*Codium fragile* (Sur.) Hariot — Syn. *C. mucronatum* J. Ag. var. *tomentosoides* van Goor — In bunches.

\**Codium tomentosum* (Huds.) Stackh. — Noordwijkerhout-Noordwijk,

10-1948, *Lucas 152, Himanthalia lorea*; Scheveningen, 30-11-1947, *Lucas 172, Himanthalia lorea*.

\**Endoderma viride* (Reinke) Lagerh. — Noordwijk, 13-11-1949, *Lucas 453, Griffithsia cf. barbata*.

*Enteromorpha clathrata* (Roth) J. Ag. — Noordwijkerhout-Noordwijk, 14-10-1948, *Lucas 31* and *Lucas 212*, wood; Katwijk, 15-10-1938, *Lacourt*, bunch of cork; Scheveningen, 13-10-1946, *Leenhouts*, *Ascophyllum nodosum*; (this species?) Scheveningen, 19-10-1941, *Koster 655*, inner shell of *sepia officinalis*.

*Enteromorpha compressa* (L.) Grev. — IJmuiden, 19-12-1949, *Mulder 13*, bunch of cork; IJmuiden-Bloemendaal, 19-12-1949, *Mulder 17*; Bloemendaal, 13-11-1949, *Stock (1)* and *Hazevoet*, cork; Zandvoort, XI-1847, *Buse*, *Fucus vesiculosus*; Noordwijk-Katwijk, 14-12-1947, *Lucas 324*, *Ascophyllum nodosum*; *ibid.*, 15-11-1949, *Lucas 502*, bunch of cork; Scheveningen, 13-10-1946, *Leenhouts*, *Ascophyllum nodosum*; *ibid.*, 16-11-1947, *Lucas 298*, bunch of cork; *ibid.*, 21-9-1948, *Leenhouts 213*, wood; *ibid.*, 22-9-1948, *Lucas 242*, *Himanthalia lorea*.

*Enteromorpha erecta* (Lyngb.) J. Ag. — Noordwijkerhout-Noordwijk, 14-10-1948, *Lucas 170*, wood.

\**Enteromorpha flexuosa* (Wulf.) J. Ag. — Zandvoort, 18-12-1949, *Stock 2*, box.

*Enteromorpha intestinalis* (L.) Link — Den Helder, 24-11-1948, *Wennen 37*, *Himanthalia lorea*; Noordwijk, 24-10-1948, *Lucas 219*, cork; Scheveningen, 18-10-1947, *Leenhouts 133*, wood.

*Enteromorpha linza* (L.) J. Ag. — Wijk aan Zee, XII-1841, *Buse*, stone; Noordwijk-Katwijk, 15-11-1949, *Lucas 492*, bunch of cork; Scheveningen, 22-10-1941, *Creutzberg*, cork.

\**Enteromorpha marginata* J. Ag. — Noordwijkerhout-Noordwijk, 14-10-1948, *Lucas 171*, wood; Scheveningen, 22-9-1948, *Lucas 208*, wood.

\**Enteromorpha prolifera* (Müll.) J. Ag. — Zandvoort, 4-3-1949, *Mulder 1*, egg capsule of *Raja clavata*.

*Monostroma spec.* — Scheveningen, 6-12-1947, *Leenhouts 202*, *Fucus vesiculosus*.

\**Protococcus marinus* Kütz. — Katwijk, 30-10-1949, *Lucas 442*, *Patella vulgata*.

\**Rhizoclonum implexum* (Dillw.) Lyngb. — Kijkduin-Terheiden, 21-1-1948, *Lucas 245*, *Himanthalia lorea*.

*Rhizoclonium riparium* (Roth) Harv. — IJmuiden, 19-12-1949, *Mulder 18*, bunch of cork.

*Ulva lactuca* L. — Noordwijkerhout-Noordwijk, 24-10-1948, *Lucas 53*, cork; Noordwijk-Katwijk, 28-2-1949, *Lucas 14*, lime-stone.

*Urospora penicilliformis* (Roth) Aresch. — Noordwijk, 28-2-1949, *Lucas 18*, lime-stone; *ibid.*, 8-5-1949, *Lucas 334*, clump of *Buccinum* eggs.

## PHAEOPHYCEAE.

*Ascophyllum nodosum* (L.) Le Jol. — Bunches are extremely common.

\**Asperococcus bullosus* Lamour. — Noordwijk, X-1948, *Rijkers*, cork.

\**Asperococcus* cf. *compressus* Griff. — Noordwijkerhout-Noordwijk 24-10-1948, *Lucas* 224, porous stone.

*Asperococcus echinatus* (Mert.) Grev. — Texel, 7-10-1946, *Bloklander* bunch of cork; Den Helder, 27-8-1948, *Swennen* 85, bunch of cork; *ibid.* 3-10-1948, *Swennen* 75, box; IJmuiden, 26-8-1948, *Stock* 3, wood; *ibid.* 19-12-1949, *Mulder* 19, bunch of cork; Bloemendaal, 13-11-1949, *Stock* (4) and *Hazevoet*, cork; Noordwijk, 4-8-1946, *Rijkers*, bunch of cork; *ibid.*, 20-9-1948, *Lucas* 69, bunch of cork; Scheveningen, 18-10-1947, *Leenhouts* 129, wood; *ibid.*, 16-11-1947, *Lucas* 68, beam; *ibid.*, *Lucas* 192, little stone Schouwen, 27-12-1947, *Viergever*, box.

\**Bifurcaria tuberculata* (Kütz.) Staekh. — Kijkduin-Terheiden, 1-10-1948, *Bloklander*, *Himanthalia lorea*.

\**Chaetopteris plumosa* (Lyngb.) Kütz. — Hondsbosse Zeewering Noordwijkerhout, 16/20-4-1949, *Mulder* 2, egg capsules of *Raja clavata* Zandvoort-Katwijk, 11-3-1949, *Lucas* 44, *ibid.*; Noordwijk-Katwijk, 15-11-1949, *Lucas* 525, *ibid.*; Scheveningen, 3-3-1949, *Lucas* 336, *ibid.*

*Chorda filum* (L.) Lamour. — Bunches are more or less common.

*Cladostephus spongiosus* (Lightf.) Ag. — Zandvoort-Noordwijk, 11-3-1949, *Lucas* 43, egg capsule of *Raja clavata*; Noordwijk-Katwijk, 15-11-1949, *Lucas* 523, *ibid.*

*Colpomenia sinuosa* (Roth) Derb. et Sol. — Only detached. Terschelling (van Goor); Bloemendaal; Noordwijkerhout; Noordwijk; Katwijk; Terheiden-Hoek van Holland.

*Cystoseira discors* (L.) J. Ag. — Once a bunch (Prodr.).

*Cystoseira ericoides* (L.) J. Ag. — Once a bunch (Prodr.).

*Cystoseira fibrosa* (Huds.) Ag. — Bunches are fairly rare. Once on an egg capsule of *Raja clavata*, Kijkduin-Hoek van Holland, 19-10-1946 *Bloklander*.

*Desmarestia aculeata* (L.) Lamour. — Scheveningen (Prodr.).

\**Dictyopteris membranacea* (Stackh.) Batt. — IJmuiden, 19-12-1949 *Mulder* 20, bunch of cork.

*Dictyota dichotoma* (Huds.) Lamour. — Noordwijk-Katwijk, 15-11-1949, *Lucas* 499, bunch of cork.

*Ectocarpus confervoides* (Roth) Le Jol. — IJmuiden, 19-12-1929 *Mulder* 21, bunch of cork; Bloemendaal, 13-11-1949, *Stock* (5) and *Hazevoet*, cork; Zandvoort, 18-12-1949, *Stock* 7, box; Noordwijkerhout-Noordwijk 24-10-1948, *Lucas* 211, wood; *ibid.*, 20-1-1949, *Lucas* 296, wood; Noordwijk-Katwijk, 15-11-1949, *Lucas* 467, bunch of cork; Scheveningen, 23-12-1947 *Leenhouts*, cork.

*Ectocarpus fasciculatus* (Griff.) Harv. — Texel, 7-10-1946, *Bloklander*, bunch of cork; Hellevoetsluis, 31-10-1948, *Mennema*, wood.

*Ectocarpus granulosus* (Engl. Bot.) Ag. — Zandvoort, 1-1844, *Busc* Zandvoort, 18-12-1949, *Stock* 6, box; Noordwijkerhout-Noordwijk, 24-10-1948 *Lucas* 210, wood; (this species?) Noordwijk, 8-5-1949, *Lucas* 304, beam Kijkduin, 20-11-1949, *Lems*, beam.

\**Ectocarpus* cf. *hincksiae* Harv. — Zandvoort-Noordwijk, 25-1-1948 *Lucas* 271, cork.

*Ectocarpus irregularis* Kütz. — Texel, 7-10-1946, *Bloklander*, bunch of cork; perhaps at Scheveningen, 18-10-1947, *Leenhouts* 128, *Phyllitis fasciata*.



**Ectocarpus paradoxus** Mont. — (this species?) IJmuiden, 19-12-1949, *Tulder* 22, bunch of cork; Kijkduin-Hoek van Holland, 19-10-1946, *Bloksander*, bunch of cork.

**Ectocarpus rufus** Ag. — Scheveningen, 1843, *Bisschop*, *Polysiphonia tomentosa* (det. Kützinger). For want of sporangia the material can not be identified with certainty.

\***Ectocarpus sandrianus** Zanard. — Noordwijkerhout-Noordwijk, 24-10-1948, *Lucas* 209, porous stone.

**Ectocarpus tomentosus** (Huds.) Lyngb. — Terschelling, 11-8-1949, *Lucas* 353, *Fucus vesiculosus*; Noordwijk, 20-9-1948, *Lucas* 165, bunch of cork; Scheveningen, *Vrijdag Zijnen*, *Ascophyllum nodosum*.

\***Ectocarpus virescens** Thur. — Noordwijk-Katwijk, 15-11-1949, *Lucas* 164, cork.

**Elachista fucicola** (Vellay) Aresch. — Terschelling, 12-8-1949, *Lucas* 357, *Fucus vesiculosus*; Noordwijkerhout-Noordwijk, 20-9-1948, *Lucas* 166 and *Lucas* 293, *ibid.*; Noordwijk, 24-10-1949, *Lucas* 431, *ibid.*; Scheveningen, e.g. 1843, *Vrijdag Zijnen*, *van den Bosch*, *Bisschop*, *van der Capelle* and *Bondam*, *ibid.*; *ibid.*, 4-10-1946, *Leenhouts*, *Fucus vesiculosus*; Hoek van Holland, 30-12-1946, *Lucas*, *ibid.*

**Elachista scutulata** (Sm.) Duby — Den Helder (van Goor); Noordwijkerhout-Noordwijk, 20-9-1948, *Lucas* 167, *Himanthalia lorea*; Noordwijkerhout, 4-8-1946, *Rijkers*, *ibid.*; Scheveningen, *Vrijdag Zijnen*, *ibid.*; *ibid.*, 6-9-1938, *Koster* 234, *ibid.*; *ibid.*, 21-9-1948, *Leenhouts*, *ibid.*

\***Eudesme virescens** (Carm.) J. Ag. — Noordwijkerhout-Noordwijk, 24-10-1948, *Lucas* 128 and *Lucas* 222, on wood, *Fucus vesiculosus* and a feather.

**Fucus ceranoides** L. — Bunches are fairly rare.

**Fucus serratus** L. — Bunches are more or less common. Often on floating *Ascophyllum nodosum*.

**Fucus spiralis** L. — Bunches are not so rare, sometimes common.

**Fucus vesiculosus** L. — Bunches are very common. Sometimes on floating objects as beams, e.g. Noordwijk, 8-5-1949, *Lucas* 321.

**Fucus serratus** L. × **Fucus vesiculosus** L. — Noordwijk-Katwijk, 6-12-1949, *Lucas* 535, 2 bunches.

**Halidrys siliquosa** (L.) Lyngb. — Bunches are more or less common.

**Herponema velutinum** (Grev.) J. Ag. — Zandkreek, 1852, *van den Bosch*, *Himanthalia lorea*.

**Himanthalia lorea** (L.) Lyngb. — Bunches are common.

**Laminaria digitata** (L.) Lamour. — Bunches are rare.

**Laminaria saccharina** (L.) Lamour. — Bunches are rare. Once on an iron buoy at Noordwijkerhout, 4-8-1946, *Rijkers*.

**Laminaria spec.** — Noordwijkerhout-Noordwijk, 10-10-1948, *Lucas* 232, *Himanthalia lorea*.

\***Mesogloia vermiculata** (Engl. Bot.) Le Jol. — Den Helder, 3-10-1948, *Swennen* 74, box; Wassenaarse Slag-Scheveningen, 23-10-1947, *Lucas* 237, beam; Scheveningen, 17-9-1941, *Creutzberg*, *Himanthalia lorea*.

**Padina pavonia** (L.) Lamour. — Scheveningen (Prodr.).

**Pelvetia canaliculata** (L.) Decne et Thur. — Once a bunch (Prodr.).

**Phyllitis fascia** (Müll.) Kütz. — Katwijk, 9-2-1946, *Rijkers*, light-buoy

N. F. 4; Scheveningen 18-10-1947, *Leenhouts* 132, beam; *ibid.*, 16-11-1947, *Lucas* 228, beam; *ibid.*, 23-12-1947, *Leenhouts* 164, cork; *ibid.*, 22-9-1948, *Lucas* 227, cork; Schouwen, 27-12-1947, *Viergever*, box.

*Pilayella littoralis* (L.) Kjellm. — Noordwijk, 28-2-1949, *Lucas* 17, *Fucus vesiculosus*; Katwijk, 11-3-1949, *Lucas* 158, cork; Katwijk-Scheveningen, 16-9-1941, *Creutzberg*, *Laminaria*; Scheveningen, *Vrijdag Zijnen*, *Ascophyllum nodosum* and *Polysiphonia lanosa*; *ibid.*, 18-10-1947, *Leenhouts* 132, beam; *ibid.*, 23-12-1947, *Leenhouts* 165, *Ascophyllum nodosum*; *ibid.*, 22-9-1948, *Lucas* 243, *Fucus vesiculosus*; Schouwen, 18-8-1941, *Viergever*, *Himanthalia lorea*.

*Punctaria plantaginea* (Roth) Grev. — Noordwijkerhout-Noordwijk, 24-10-1948, *Lucas* 207, porous stone; Scheveningen, *Vrijdag Zijnen*, wood.

*Saccorhiza bulbosa* (Huds.) de la Pyl. — Scheveningen, 7-9-1941, *Creutzberg*, bunch of cork; Schouwen, 11-12-1949, *Viergever*, bunch of cork. Also once a bunch at Schouwen.

*Sargassum natans* (L.) Borg. — Once a bunch at Scheveningen.

*Scytosiphon lomentarius* (Lyngb.) J. Ag. — Noordwijk, 24-10-1948, *Lucas* 96, wood.

*Sphacellaria cirrhosa* (Roth) J. Ag. — Noordwijkerhout-Noordwijk, 20-9-1948, *Lucas* 127, *Chorda filum*; *ibid.*, 10-10-1948, *Lucas* 189, *Himanthalia lorea*; Noordwijk-Katwijk, 28-2-1949, *Lucas* 16, lime-stone.

## RHODOPHYCEAE.

*Acrosorium reptans* (Crouan) Kylin — Texel, 7-10-1946, *Bloklander*, bunch of cork; Den Helder, 24-11-1948, *Swennen* 13 and *Swennen* 48, *Himanthalia lorea*; Katwijk-Scheveningen, 7-11-1948, *Lucas* 388, *Himanthalia lorea*; *ibid.*, 16-11-1948, *Lucas* 32, *Himanthalia lorea*.

*Acrosorium uncinatum* (J. Ag.) Kylin — Den Helder, 24-11-1948, *Swennen* 14, *Himanthalia lorea*; IJmuiden-Bloemendaal, 19-12-1949, *Mulder* 23, *Himanthalia lorea*; IJmuiden-Zandvoort, 28-12-1949, *Lucas* 542, *Himanthalia lorea*; Zandvoort, 1-1844, *Buse*; Noordwijkerhout-Noordwijk, 10-10-1948, *Lucas* 34, *Himanthalia lorea*; Noordwijk, 5-10-1948, *Rijkers*, *Himanthalia lorea*; Noordwijk-Katwijk, 6-12-1949, *Lucas* 527, *Himanthalia lorea*; Katwijk-Scheveningen, 7-11-1948, *Lucas* 36, *Himanthalia lorea*; *ibid.*, 16-11-1948; *Lucas* 32 and *Lucas* 33, *Himanthalia lorea*; Scheveningen, 30-11-1947, *Lucas* 265, *Himanthalia lorea*; Kijkduin-Terheiden, 21-11-1948, *Lucas* 35, *Himanthalia lorea*; Terheiden-'s Gravenzande, 14-11-1948, *Bloklander*, stone; Hoek van Holland, 18-12-1949, *Lucas* 536, *Himanthalia lorea*; Schouwen, 18-10-1941, *Viergever*, *Himanthalia lorea*.

*Antithamnion cruciatum* (Ag.) Näg. — Katwijk-Scheveningen, 16-11-1948, *Lucas* 54, *Himanthalia lorea*.

*Antithamnion plumula* (Ellis) Thur. — Den Helder, 24-11-1948, *Swennen* 12, *Himanthalia lorea*; *ibid.*, 26-11-1948, *den Hartog*, *Himanthalia lorea*; IJmuiden, 19-12-1949, *Mulder* 24, bunch of cork; Noordwijkerhout-Noordwijk, 20-9-1948, *Lucas* 55, cork; *ibid.*, 20-1-1949, *Lucas* 92, bunch of cork; Noordwijk-Katwijk, 5-11-1949, *Lucas* 516, *Halidrys siliquosa*; Katwijk-Scheveningen, 7-11-1949, *Lucas* 385, *Himanthalia lorea*; Terheiden-'s Gravenzande, 14-11-1948, *Bloklander*, *Himanthalia lorea*.

**Antithamnionella sarniensis** Lyle — A very common species. Found at Den Helder (*Swennen* 18), IJmuiden, 19-12-1949, *Mulder* 6, bunch of cork; everywhere between Zandvoort and Hoek van Holland; Schouwen; collectors *Stock* (8, 9), *Bloklander*, *Viergever*, *Lucas* (45, 50, 51, 52, 53, 273, 295, 329, 462, 481, 529). Found on a great number of species of algae, cork, bunches of cork and *Patella vulgata*.

**Antithamnionella sarniensis** Lyle var. **crassa** J. Lucas, nov. var. Cellulis axis principalis crassis,  $\frac{3}{4}$ — $1\frac{1}{4}$  longitudinis latis, ad  $140\ \mu$  latis; ramulis unilateraliter ramosis raris.

Type: IJmuiden, 19-12-1949, *Mulder* 55, bunch of cork.

Cotypes: IJmuiden, 19-12-1949, *Mulder* 56 and 57, same bunch of cork.

All specimens with tetraspores.

**Apoglossum ruscifolium** (Turn.) J. Ag. — Noordwijk-Katwijk, 15-11-1949, *Lucas* 485, bunch of cork.

**Bangia fusco-purpurea** (Dillw.) Lyngb. — IJmuiden 19-12-1949, *Mulder* 25, bunch of cork; Zandvoort, 4-3-1949, *Mulder* 3, egg capsule of *Raja clavata*; (this species?) Noordwijk-Katwijk, 15-11-1949, *Lucas* 495, bunch of cork; Kijkduin-Terheiden, 21-11-1948, *Lucas* 70, *Ascophyllum nodosum*.

**Bostrychia scorpioides** (Gmel.) Mont. — Noordwijkerhout-Noordwijk, 5-11-1948, *Lucas* 73, *Himanthalia lorea*.

\***Calliblepharis ciliata** (Huds.) Kütz. — Den Helder, 24-11-1948, *Swennen* 17, *Himanthalia lorea*; (this species?) Noordwijkerhout-Noordwijk, 7-12-1947, *Lucas* 253, *Patella vulgata*; Katwijk-Wassenaarse Slag, 10-12-1947, *Lucas* 74, *Patella vulgata*.

**Callithamnion byssoides** Arn. — Noordwijk-Katwijk, 15-11-1949, *Lucas* 475, 507 and 508, bunch of cork.

**Callithamnion corymbosum** (Sm.) Lyngb. — Den Helder, 24-11-1948, *Swennen* 23, *Himanthalia lorea*; (this species?) Zandvoort, XII-1841, *Buse*, *Himanthalia lorea*; Noordwijkerhout-Noordwijk, 5-11-1948, *Lucas* 75, *ibid.*; *ibid.*, 20-1-1949, *Lucas* 91, bunch of cork; *ibid.*, 10-10-1948, *Lucas* 76, *Himanthalia lorea*; Noordwijk-Katwijk, 15-11-1948, *Lucas* 474, bunch of cork; Wassenaarse Slag-Scheveningen, 30-11-1947, *Lucas* 284, *Fucus serratus*; (this species?) Scheveningen, 13-10-1946, *Leenhouts* 141, *Himanthalia lorea*.

\***Callithamnion fruticulosum** J. Ag. — Scheveningen, 30-10-1949, *Lems*.

**Callithamnion granulatum** (Ducluz.) Ag. — Noordwijk-Katwijk, 15-11-1949, *Lucas* 473 and 501, bunch of cork.

**Callithamnion hookeri** (Dillw.) Ag. — On *Himanthalia lorea* frequent everywhere between Zandvoort and Scheveningen (*Buse*, *Rijkers*, *Lucas* 118, 119, 120, 121, 320, 327, 375, 528 and 529); Schouwen, 23-10-1948, *Viergever*, bunch of cork. Once on *Halidrys siliquosa*.

**Callithamnion roseum** (Roth) Harv. — Terschelling, 15-8-1949, *Lucas* 370, beam; Zandvoort-Noordwijk, 26-11-1949, *Stock* 10.

**Callithamnion tetragonum** (Wither) Ag. — A very common species. Den Helder, 24-11-1948, *Swennen* 26, *Himanthalia lorea*; Wijk aan Zee, I-1844, *Buse*, *Himanthalia lorea* and *Fucus* spec.; IJmuiden, 19-12-1949, *Mulder* 26, bunch of cork; everywhere between Zandvoort and Hoek van



Holland (*Buse, Rijkers, Lacourt, Bloklander, Lucas 123, 124, 125, 126, 203, 223, 241, 255, 278, 389, 457 and 530*), *Himanthalia lorea*, *Halydris siliquosa*, *Fucus platycarpus*, *Corallina officinalis*, cork; Schouwens, 23-10-1948, *Viergever*, bunch of cork.

**Callithamnion tetragonum** (Wither) Ag.  $\beta$  **brachiatum** (Bonn.) J. Ag. — IJmuiden, 19-12-1949, *Mulder 27*, bunch of cork; Zandvoort-Noordwijk, 26-11-1949, *Stock 11*; Noordwijk-Katwijk, 15-11-1949, *Lucas 491*, bunch of cork.

\***Callithamnion cf. tetricum** (Dillw.) Ag. — Zandvoort-Noordwijk, 25-1-1948, *Lucas 264*, cork. In Prodr. a wrong identification is to be found. Already Van Goor found that this material of Scheveningen belongs to *C. tripinnatum*.

**Callithamnion tripinnatum** (Grat.) Ag. — Zandvoort, 1-1844, *Buse*; Noordwijk-Katwijk, 14-12-1947, *Lucas 312*, *Ascophyllum nodosum*; Scheveningen, *Bisschop*.

In the present paper only a few remarks will be made about the species belonging to the difficult genus *Ceramium* Roth.

#### A) Species with spines.

\***Ceramium ciliatum** (Ellis) Ducluz., **Ceramium ciliatum** (Ellis) Ducluz. f. **acanthonotum** Harv., \***Ceramium echionotum** J. Ag. and \***Ceramium flabelligerum** J. Ag. were found. It is doubtful whether *Ceramium acanthonotum* Carm. is a good species, for sometimes parts with whorls of spines and parts with spines on the outer side of the node only are found on the same plant. Material from Den Helder has nodes, characteristic for *C. acanthonotum*, but also a great number of nodes, intermediate between those of *C. ciliatum* and those of *C. acanthonotum*.

#### B) Species without spines.

##### 1) **Ceramium deslongchampsii** Chauv.

Syn.: *Gongroceras strictum* Kütz.; *Ceramium strictum* (Kütz.) Harv.; *Ceramium diaphanum* (Lightf.) Roth var. *strictum* (Kütz.) Feldmann-Mazoyer.

This species was only twice found on drifting objects.

The author was able to study the type of *Gongroceras strictum* Kütz.; it is a synonym of *C. deslongchampsii* Chauv. Harvey made a new combination, *Ceramium strictum* (Kütz.) Harv., which is based on the species *Gongroceras strictum* Kütz.

##### 2) **Ceramium diaphanum** (Lightf.) Roth.

a) *C. diaphanum* (Lightf.) Roth var. *typicum* has not yet been recorded from drifting objects.

##### b) **C. diaphanum** (Lightf.) Roth f. **strictoides** H. Petersen.

This form is not rare on drifting objects.

The algae which thusfar were identified as *C. strictum* (Kütz.) Harv. in my opinion belong to a form of *C. diaphanum* (Lightf.) Roth. Therefore the name must be as indicated above.

##### c) **C. diaphanum** (Lightf.) Roth f. **tenuissimum** Lyngh.

Syn.: *Gongroceras tenuissimum* Kütz.

In the herbarium of Kützing at Leiden a label, on which is written "Original v. Lyngbye" in Kützing's handwriting, belongs to a few specimens. These specimens do not show gland cells, while also the apices

are only feably dentate. Therefore it is not impossible that *Ceramium arachnoideum* J. Ag. is a synonym of *C. tenuissimum* (Lyngb.) J. Ag. According to Kylin *Ceramium arachnoideum* J. Ag. is not essential different from *C. diaphanum* (Lightf.) Roth f. *strictoides* H. Petersen. The same applies to *C. tenuissimum* (Lyngb.) J. Ag. The intermediate forms between *C. diaphanum* (Lightf.) Roth f. *strictoides* H. Petersen and *C. tenuissimum* (Lyngb.) J. Ag. which have been found by me, are in accordance with this opinion. This form is not rare on drifting objects.

d) **C. diaphanum** (Lightf.) Roth f. **cateniforme** (Kütz.) J. Lucas, nov. comb.

Syn.: *Hormoceras cateniforme* Kütz.

The lowest part of the type of this form, preserved at the Rijks-herbarium, Leiden, shows nodes with upward proliferation of the corticating cells. However, no internode is completely corticated. For the rest there are no differences with *C. diaphanum* (Lightf.) Roth. *Hormoceras cateniforme* has to be considered as a form of *C. diaphanum* (Lightf.) Roth. The form is not rare on drifting objects.

e) **C. diaphanum** (Lightf.) Roth. f. **corticatum** (Kylin) Sjöstedt.

In connection to the above mentioned remark (d), and in connection to the fact, that the form also occurs on drifting objects, I agree with Sjöstedt and consider *C. corticatum* Kylin as a form of *C. diaphanum* (Lightf.) Roth. *Gongroceras tenuicorne* Kütz. is not identical with *C. corticatum* Kylin, as Kylin supposed. The greater part of Kützing's material belongs to *C. diaphanum* (Lightf.) Roth f. *tenuissimum* Lyngb.; one specimen, however, which agrees with the figure in Kützing's *Tabulae Phycologiae* and must be considered the type, differs from the other specimens, and possibly belongs to a separate species.

3) \***Ceramium rescissum** Kylin and **Ceramium rubrum** (Huds.) Ag. are known from drifting objects too.

4) A number of specimens, belonging to *Ceramium*, could not be identified with certainty as yet.

**Chantransia davesii** (Dillw.) Thur. — Bloemendaal, 13-11-1949, *Stock* (12) and *Hazevoet*, cork; Noordwijk, 20-9-1949, *Lucas* 56, bunch of cork; Scheveningen (Prodr.).

**Chantransia virgatula** (Harv.) Thur. — Zandvoort, 4-3-1949, *Mulder* 4, *Ceramium rubrum*.

\***Chondria dasyphylla** (Woodw.) Ag. — IJmuiden, 19-12-1949, *Mulder* 28, bunch of cork; on 20—22-IX-1948 in a great number on many kinds of substrata, everywhere between Noordwijkerhout and Kijkduin, *Lucas* 127, 131, 133; Noordwijkerhout-Noordwijk, 24-10-1948, *Lucas* 132, *Ascophyllum nodosum*.

\***Chondria tenuissima** (G. et W.) Ag. — IJmuiden, 19-12-1949 *Mulder* 29, bunch of cork; Noordwijkerhout-Noordwijk, 24-10-1948, *Lucas* 134, lime, cork, *Himanthalia lorea* and *Ascophyllum nodosum*; Noordwijk-Katwijk, 14-12-1947, *Lucas* 326, *Himanthalia lorea*; ibid., 15-11-1949, *Lucas* 459, cork; ibid., 15-11-1949, *Lucas* 480, bunch of cork; Katwijk-Scheveningen, 16-11-1948, *Lucas* 135, *Himanthalia lorea*.

**Chondrus crispus** (L.) Stackh. — (this species?) Zandvoort, 1840, *Buse*, *Himanthalia lorea*; Noordwijkerhout-Noordwijk, 7-12-1947, *Lucas* 136,

*Patella vulgata*; Noordwijk-Katwijk, 15-11-1949, *Lucas* 458, cork; Scheveningen, 1-10-1948, *Bloklander*, *Patella vulgata*; Schouwen, VIII-1946, *Bloklander*, *Himanthalia lorea*.

\**Corallina* cf. *granifera* Ell. et Sol. — Noordwijk, 13-11-1949, *Lucas* 456, egg capsule of *Raja clavata*.

*Corallina officinalis* L. A common species, especially on *Himanthalia lorea*. Terschelling, VIII-1949, *Lucas* 355; Den Helder 24-11-1948, *Swennen* 12; everywhere between IJmuiden and Hoek van Holland (*Mulder* 5 and 35, *Rijkers*, *Bloklander*, *Lucas* 153, 280, 312, 318, 355, 374, 539, 546); Schouwen, *Viergever*.

*Corallina rubens* L. — IJmuiden-Zandvoort, 28-12-1949, *Lucas* 543, *Himanthalia lorea*; Noordwijkerhout-Noordwijk, 10-10-1948, *Lucas* 154, *ibid.*; Katwijk-Scheveningen, 21-9-1948, *Lucas* 155, *Chorda filum*.

*Corallina squamata* Ell. et Sol. — Noordwijkerhout-Noordwijk, 7-12-1947, *Lucas* 156, *Patella vulgata*; Scheveningen, XII-1843, *van den Capelle*, *Himanthalia lorea*.

\**Cordylecladia erecta* (Grev.) J. Ag. — Scheveningen, 31-10-1948, *Sprong*, *Himanthalia lorea*.

\**Cryptopleura ramosa* (Batt.) Kylin — Den Helder, 24-11-1948, *Swennen* 13, *Himanthalia lorea*; Noordwijk, 5-10-1948, *Rijkers*, *Himanthalia lorea*; Noordwijk-Katwijk, 15-11-1949, *Lucas* 505, bunch of cork; Terheiden's Gravenzande, 14-11-1948, *Bloklander*, *Himanthalia lorea*.

\**Cruoriella dubyi* (Crouan) Schmitz — Scheveningen, 13-10-1946, *Leenhouts*, *Himanthalia lorea*.

*Cystoclonium purpurascens* (Huds.) Kütz. — Den Helder, 26-11-1948, *den Hartog*, *Himanthalia lorea*; IJmuiden-Bloemendaal, 19-12-1949, *Mulder* 58, *Himanthalia lorea*; Noordwijkerhout-Noordwijk, 11-11-1948, *Lucas* 161, *ibid.*; *ibid.*, 5-11-1948, *Lucas* 328, *ibid.*; Katwijk-Scheveningen, 16-11-1948, *Lucas* 159, *ibid.*; Kijkduin Terheiden, 21-11-1948; *Lucas* 160, *ibid.*; Terheiden's Gravenzande, 14-11-1948, *Bloklander*, *ibid.*

\**Dasya arbuscula* Ag. — IJmuiden, 19-12-1949, *Mulder* 30, 31 and 32, bunch of cork.

\**Dasya ocellata* (Grateloup) Harv. — Noordwijk-Katwijk, 15-11-1949, *Lucas* 470, bunch of cork.

*Dasya pedicellata* (Ag.) Ag. — Zandvoort. In the Rijksherbarium at Leiden material from Venice from Agardh is not to be found, though van Goor mentioned this material. Only some plants of *Dasya*, on *Himanthalia lorea*, on a piece of mica and on a piece of glass have been preserved. According to the label, on which is written "supra varias algas", all this material did belong to Buse; van Goor, however, stated that no material from Buse was present. It is dated I-1844.

*Dumontia filiformis* (Fl. Dan.) Grev. — Noordwijkerhout-Noordwijk, 10-10-1948, *Lucas* 163, *Himanthalia lorea*.

\*cf. *Erythropeltis discigera* (Berthold) Schmitz — Noordwijkerhout-Noordwijk, 24-10-1948, *Lucas* 194, *Nitophyllum punctatum*; Schouwen, X-1942, *Viergever*, *Laomedea* spec.

\**Falkenbergia hillebrandii* (Born.) Falkenb. — A common species; especially on *Himanthalia*. Den Helder, *Swennen* 25, *den Hartog*; IJmuiden, 19-12-1949, *Mulder* 33, bunch of cork; IJmuiden-Zandvoort, 19-12-1949,



*Mulder 34, Gastroclonium ovale*; Zandvoort, *Mulder 6*; everywhere between Noordwijkerhout and Hoek van Holland, IX—XII, 1947—1949, *Rijkers, Bloklander and Lucas 102, 103, 104, 105, 106, 460, 468, 532, 533*.

\**Gastroclonium clavatum* (Roth) Ardiss. — Noordwijk, 24-10-1948, *Lucas 141*, cork:

*Gastroclonium kaliforme* (G. et W.) Ardiss. — Den Helder, 24-11-1948, *Swennen 27, Himanthalia lorea*; IJmuiden-Bloemendaal, 19-12-1949, *Mulder 35, Himanthalia lorea*; Zandvoort, I-1844, *Buse*, cork and *Cystoseira fibrosa*; Zandvoort-Noordwijk, 26-11-1949, *Stock 13*, cork; Noordwijkerhout-Noordwijk, 20-9-1948, 10-10-1948, 24-10-1948, 5-11-1948, 11-11-1948, *Lucas 13, 142, 143, 144, 234*, on *Himanthalia lorea, Chorda filum* and cork; Scheveningen, 19-9-1946, *Leenhouts*, bunch of cork.

*Gastroclonium ovale* (Huds.) Kütz. — A common species, especially on *Himanthalia lorea*. Terschelling, 15-8-1949, *Lucas 356*; Den Helder, 24-11-1948, *Swennen 38*; everywhere between Wijk aan Zee and Hoek van Holland; Schouwen, 18-8-1941, *Viergever*.

\**Gelidium attenuatum* (Turn.) Thur. — Noordwijk-Katwijk, 14-12-1947, *Lucas 178, Patella vulgata*.

*Goniotrichum elegans* (Chauv.) Zanard. — Noordwijkerhout-Noordwijk, 20-9-1948, *Lucas 180, Chorda filum*; Noordwijk-Katwijk, 15-11-1949, *Lucas 507*, bunch of cork; Wassenaarse Slag-Scheveningen, 30-11-1947, *Lucas 290, Ascophyllum nodosum*; Scheveningen, 23-12-1947, *Leenhouts 168*, cork.

*Gracilaria confervoides* (L.) Grev. — Noordwijk, 8-5-1949, *Lucas 335*, clump of *Buccinum* eggs.

\**Grateloupia filicina* (Wulf.) Ag. — Scheveningen, 31-10-1948, *Sprong, Himanthalia lorea*. The record from Scheveningen (Prodr. and later cited by van Goor) was a mistake. The specimen, according to the cross-section, belongs to *Gyrodinium aureolum*.

*Griffithsia* cf. *barbata* (Sm.) Ag. — Noordwijk, 13-11-1949, *Lucas 453*, egg capsule of *Raja clavata*; Noordwijk-Katwijk, 15-11-1949, *Lucas 524*, egg capsule of *Raja clavata*.

\**Griffithsia setacea* (Ellis) Ag. — Katwijk-Scheveningen, 7-11-1948, *Lucas 181, Himanthalia lorea*; Kijkduin-Terheiden, 21-11-1949, *Lucas 38, Himanthalia lorea*.

\**Haematocelis rubens* J. Ag. — Katwijk-Scheveningen, 16-11-1948, *Lucas 182, Himanthalia lorea*.

\**Halurus equisetifolius* (Lightf.) Kütz. — Noordwijkerhout-Noordwijk, 24-10-1948, *Lucas 186, Himanthalia lorea*.

*Heterosiphonia coccinea* (Ellis) Batt. — Den Helder, 24-11-1948, *Swennen 39, Himanthalia lorea*; Zandvoort, I-1844, *Buse*; Noordwijkerhout-Noordwijk, 24-10-1948, *Lucas 205, Himanthalia lorea*; *ibid.*, 5-11-1948, *Lucas 333*; *ibid.*, 20-1-1949, *Lucas 93*, bunch of cork; Wassenaarse Slag-Scheveningen, 30-11-1947, *Lucas 270, Himanthalia lorea*; Scheveningen-Hoek van Holland, 18-12-1949, *Lucas 533, Himanthalia lorea*; Kijkduin, 18-12-1949, *Ascophyllum nodosum*.

*Hypoglossum woodwardii* Kütz. — Common. Everywhere between Wijk aan Zee and 's Gravenzande; *Buse, Vrijdag Zijnen, Mulder 7, Bloklander, Lucas 183, 184, 185, 212, 292, 362, 386, 486, 531, 541*; most on *Himanthalia lorea*.

\**Laurencia* cf. *caespitosa* Lamour. — Noordwijk-Katwijk, 15-11-1949, Lucas 463, cork.

\**Laurencia* cf. *obtus*a (Huds.) Lamour. — Noordwijkerhout-Noordwijk, 20-9-1948, Lucas 23, *Himanthalia lorea*.

*Laurencia pinnatifida* (Gmel.) Lamour. — Very common. Terschelling. Den Helder, everywhere between IJmuiden and 's Gravenzande, Schouwen. Most on *Himanthalia lorea*.

\**Lithothamnion calcareum* (Pallas) Aresch. — Terschelling, 16-8-1940, Geelhoed, clump of *Buccinum* eggs; ibid., 23-7-1947, van Haren, ibid.

*Lithothamnion lenormandii* (Aresch.) Foslie — Noordwijk-Katwijk, 28-2-1949, Lucas 14, lime-stone; Katwijk, 15-10-1938, Lacourt, bunch of cork.

*Lomentaria articula* (Huds.) Lyngh. — Zandvoort, XII-1841, Buse, *Himanthalia lorea*; ibid., I-1844, Buse, *Himanthalia lorea* and cork; (this species?) Noordwijkerhout-Noordwijk, 5-11-1948, Lucas 235, *Himanthalia lorea*.

*Melobesia lejolisia* Rosan. — Zandvoort, I-1844, Buse, *Himanthalia lorea*; Wassenaarse Slag-Scheveningen, 21-9-1948, Lucas 236, *Chondria dasyphylla*. Probably not uncommon; most colonies are very young.

\**Melobesia zonalis* (Crouan) Foslie — IJmuiden-Bloemendaal, 19-12-1949, Mulder 8, *Himanthalia lorea*; Noordwijk, 5-10-1948, Rijkers, *Himanthalia lorea*; Noordwijk-Katwijk, 15-11-1949, Lucas 509, bunch of cork.

*Membranoptera alata* (Huds.) Stackh. — Katwijk (Prodr.).

*Neomonospora pedicellata* (Sm.) G. Feldm. et Meslin — Syn. *Monospora pedicellata* (Sm.) Sol. — Katwijk-Scheveningen, 16-11-1948, Lucas 238, *Himanthalia lorea*; Scheveningen, 30-11-1947, Lucas 276, *Himanthalia lorea*; (this species?) Scheveningen-Hoek van Holland, 18-12-1949, Lucas 538, *Himanthalia lorea*.

\**Nitophyllum punctatum* (Stackh.) Grev. — IJmuiden-Bloemendaal, 19-12-1949, Mulder 9, *Himanthalia lorea*; Zandvoort, I-1844, Buse, *Halidrys siliquosa*; Noordwijkerhout-Noordwijk, 24-10-1948, Lucas 194, *Himanthalia lorea*; ibid., 5-11-1948, Lucas 225, *Himanthalia lorea*; Katwijk-Scheveningen, 7-11-1948, Lucas 387, *Himanthalia lorea*; Hoek van Holland, 18-12-1949, Lucas 535, *Himanthalia lorea*.

\**Peyssonnelia atropurpurea* Crouan — IJmuiden-Bloemendaal, 19-12-1949, Mulder 10, *Himanthalia lorea*; Terheiden-'s Gravenzande, 14-11-1948, Bloklander, *Himanthalia lorea*.

\**Peyssonnelia rubra* (Grev.) J. Ag. — Den Helder, 24-11-1948, Swennen 46, *Himanthalia lorea*; Katwijk-Scheveningen, 7-11-1948, Lucas 376, *Himanthalia lorea*.

\**Phyllophora membranifolia* (G. et W.) J. Ag. — Noordwijkerhout-Noordwijk, 10-10-1948, Lucas 239, *Himanthalia lorea*; ibid., 24-10-1948, Lucas 240, *Himanthalia lorea*.

cf. *Pleonosporium borrieri* (Sm.) Näg. — Zandvoort, I-1844, Buse, *Halidrys siliquosa*; Noordwijk, 8-5-1949, Lucas 303, beam; Katwijk-Scheveningen, 8/9-2-1949, Lucas 307, *Polysiphonia lanosa*.

*Plocamium coccineum* (Huds.) Lyngh. — Zandvoort, I-1844, Buse, *Halidrys siliquosa*; Zandvoort-Katwijk, 11-3-1949, Lucas 322, egg capsule of *Raja clavata*; Noordwijkerhout-Noordwijk, 5-11-1948, Lucas 231, *Himanthalia lorea*; Noordwijk, 8-5-1949, Lucas 300, clump of *Buccinum* eggs;

ibid., 13-11-1949, *Lucas* 445, egg capsule of *Raja clavata*; Noordwijk-Katwijk, 15-11-1949, *Lucas* 526, ibid.; Katwijk-Scheveningen, 7-11-1948, *Lucas* 229, *Himanthalia lorea*; ibid., 16-11-1948, *Lucas* 230, *Himanthalia lorea*; Scheveningen, *Bisschop*; Kijkduin-Hoek van Holland, 4-12-1946, *van Haren*, egg capsule of *Raja clavata*.

\**Polysiphonia brodiaei* (Dillw.) Grev. — Texel, 7-10-1946, *Bloklander*, bunch of cork; Noordwijkerhout-Noordwijk, 10-10-1948, *Lucas* 99, *Himanthalia lorea*; Noordwijk-Katwijk, 15-11-1949, *Lucas* 478, 490 and 506, bunch of cork; Scheveningen, 19-9-1946, *Leenhouts* 140, bunch of cork.

*Polysiphonia denudata* (Dillw.) Kütz. — IJmuiden, 19-12-1949, *Mulder* 11, bunch of cork; Zandvoort-Noordwijk, 26-11-1949, *Stock* 14, bunch of cork; Noordwijkerhout-Noordwijk, 10-10-1948, *Lucas* 101, *Himanthalia lorea*; ibid., 20-1-1949, *Lucas* 3, cork; Noordwijk-Katwijk, 15-11-1949, *Lucas* 476, bunch of cork.

*Polysiphonia elongata* (Huds.) Harv. — Scheveningen, 19-10-1946, *Leenhouts* 144, bunch of cork.

\**Polysiphonia* cf. *elongella* Harv. — Zandvoort-Noordwijk, 26-11-1949, *Stock* 15, cork.

*Polysiphonia lanosa* (L.) Tandy — Very common. Terschelling, Texel, Den Helder, everywhere between IJmuiden and Hoek van Holland. Always on *Ascophyllum nodosum*.

*Polysiphonia nigra* (Huds.) Batt. — IJmuiden, 19-12-1949, *Mulder* 12, bunch of cork; Scheveningen, 23-12-1947, *Leenhouts* 170, cork.

*Polysiphonia nigrescens* (Dillw.) Grev. — Texel, 7-10-1946, *Bloklander*, bunch of cork; Noordwijk-Katwijk, 15-11-1949, *Lucas* 522, egg capsule of *Raja clavata*; Scheveningen, 23-12-1947, *Leenhouts* 167, cork.

*Polysiphonia urceolata* (Lightf.) Grev. — IJmuiden, 19-12-1949, *Mulder* 13, bunch of cork; Scheveningen, 23-12-1947, *Leenhouts* 169, bunch of cork; Terheiden, 19-1-1948, *Lensink*, wood.

*Polysiphonia violacea* (Roth) Grev. — Texel, 7-10-1946, *Bloklander*, bunch of cork; Noordwijkerhout-Noordwijk, 5-11-1948, *Lucas* 100, cork; Noordwijk-Katwijk, 15-11-1949, *Lucas* 469, bunch of cork.

*Porphyra laciniata* (L.) J. Ag. — Zandvoort, 1-1844, *Buse*, *Chorda filum*; Noordwijkerhout-Noordwijk, 20-1-1949, *Lucas* 94, bunch of cork; Noordwijk-Katwijk, 15-11-1949, *Lucas* 519, branch; Scheveningen, *Vrijdag Zijnen*, ship's mast.

*Ptilota plumosa* (L.) Ag. — Friesland (Prodr.); Zandvoort (van Goor).

\**Ptilothamnion pluma* (Dillw.) Thur. — Den Helder, 24-11-1948, *Swennen* 15, *Himanthalia lorea*.

\**Rhodochorton membranaceum* Magn. — Several times there has been found a small red alga within the hydrothecae of *Laomedea geniculata* (*Hydrozoa*) which probably belongs to this species.

*Rhodochorton rothii* (Lyngh.) Näg. — Noordwijk, 8-5-1949, *Lucas* 305, beam; Noordwijk-Katwijk, 15-11-1949, *Lucas* 510, bunch of cork; ibid., 6-12-1949, *Lucas* 532, *Himanthalia lorea*; Scheveningen, *Vrijdag Zijnen*, *Himanthalia lorea*.

*Rhodomela lycopodioides* (L.) J. Ag. — Den Helder, 24-11-1948, *Swennen* 41, *Himanthalia lorea*; Noordwijkerhout-Noordwijk, 5-11-1948, *Lucas* 206, *Himanthalia lorea*; Noordwijk, 5-10-1948, *Rijkers*, *Himanthalia*



*lorea*; Kijkduin-Terheiden, 21-11-1948, *Lucas* 39, *Himanthalia lorea*.

As far as I can judge from the material in the Rijksherbarium, Leiden, there is no difference between *R. subfusca* (Woodw.) Ag. and *R. lycopodioides*.

*Rhodophyllis bifida* (G. et W.) Kütz. — The record from Zandvoort (Prodr. and later cited by van Goor) was based on a wrong identification. The specimen concerned belongs to *Acrosorium uncinatum*.

*Rhodymenia palmata* (L.) Grev. — Zandvoort (Prodr.).

\**Seirospora gaillonii* (Crouan) de Toni — IJmuiden, 19-12-1949, *Mulder* 14, bunch of cork.

*Spermothamnion turneri* (Mert.) Aresch. — Kijkduin, 18-12-1949, *Lucas* 531, *Ascophyllum nodosum*.

\**Spyridia filamentosa* (Wulf.) Harv. — IJmuiden, 19-12-1949, *Mulder* 15, bunch of cork.

\**Trailliella intricata* (J. Ag.) Batt. — Kijkduin-Terheiden, 21-11-1948, *Lucas* 37, *Himanthalia lorea*.

### Literature.

- BLOKLANDER en J. BROUWER, A. E. H. M., De natuurlijke adventieve Loricata, Gastropoda en Lamellibranchiata van het Nederlandsche strand — *Basteria* 10, 1946, 49—64, and 11, 1947, 89—100.
- CARRUTHERS, J. N., The water movements in the Southern North Sea, Part I. The surface drift — *Fish. Invest. Series II*, vol. VIII, n. 2, 119 pp. XII erts, LXXX tab., 1925.
- FELDMANN—MAZOYER, G., Recherches sur les Ceramiacées de la Méditerranée occidentale; Alger 1940.
- GEITLER, L., Cyanophyceae — *Rabenhorst Kryptogamenflora*, Bd. 14; Leipzig, 1932.
- GOOR, A. C. J. van, Die Holländische Meeresalgen — *Verh. Kon. Akad. Wetensch. Amsterdam*, 2e Sect. Dl. XXIII, No. 2, 1923.
- HAMEL, G., Floridées de France. Bangiales — *Rev. Algol.* I, 1924—1925, 278—293 and 427—457.
- , Chlorophycées des côtes françaises — *Ibid.* I, 1924, 168—174, 293—297 and 458—461; II, 1925, 68—71; IV, 1929, 43—76; V, 1930, 1—55 and 383—430; VI, 1931, 9—73.
- , Phéophycées de France, I, Ectocarpales, 1931.
- HAEVEY, W. H., *Phycologia Britannica*; Londen, 1846—1851.
- HAUCK, F., Die Meeresalgen Deutschlands und Oesterreichs — *Rabenhorst Kryptogamenflora*, Bd. 2; Leipzig, 1885.
- KOLDERUP ROSENVINCE, L., The marine algae of Denmark, I, Rhodophyceae — *D. Kgl. Danske Vidensk. Selsk. Skrifter*, 7. Raekke, Naturvidensk. og Mathem. Afd., VII. 1—4; Kjøbenhavn, 1909—1931.
- KOSTER, Joséphine Th., Quelques observations sur les Bryopsis du Golfe de Naples — *Blumea*, IV, n. 2, 1941, 225—258.
- KÜTZING, F. T., *Ueber Ceramium* Ag. — *Linnaea* XV, 1841—2, 727—746.
- , *Species Algarum*; Lipsiae, 1849.
- , *Tabulae Phycologiae* Bd. I—XIX, 1845—1869.
- KYLIN, H., Studien über die Algenflora der schwedischen Westküste, Akademische Abhandlung; Upsala, 1907.
- , Bemerkungen über einige Ceramium-Arten — *Botaniska Notiser* 1924; 443—452; Lund, 1924.
- , Studien über die Delesseriaceen — *Lunds Univ. Arsskrift. N. F. Adv.* 2. Bd. 20. Nr 6; Lund, 1924.
- , Die Phaeophyceenordnung Chordariales — *Ibid.* Bd. 36. Nr 9; Lund, 1940.
- , Die Rhodophyceen der Schwedischen Westküste — *Ibid.* Bd. 40. Nr 2; Lund, 1944.
- , Die Phaeophyceen der Schwedischen Westküste — *Ibid.* Bd. 43. Nr. 4; Lund, 1947.

- AKOWITZ, K., Die Algenflora der gesammten Ostsee; Dantzig, 1929.
- LEVING, Tore, Zur Kenntnis der Algenflora der Norwegischen Westküste — Lunds Univ. Arsskrift, N. F. Avd. 2. Bd. 33. Nr 8; Lund, 1937.
- NEWTON, L., A handbook of the British Seaweeds; London, 1931.
- PETERSEN, H. E., Danske Arter af Slægten Ceramium (Roth) Lyngbye — D. Kgl. Danske Vidensk. Selsk. Skrifter, 7. Raekke, Naturvidensk. og Mathem. Afd. V. 2; København, 1908.
- PRODROMUS FLORAE BATAVAE, Vol. II, pars II, 1853, 169—236.
- SJÖSTEDT, L. G., Undersökningar öfver Oeresund, XIV — Revision of some dubious Swedish Ceramium types, their classification and ecology — Lunds Univ. Arsskrift, N. F. Avd. 2. Bd. 23. Nr. 12; Lund, 1928.
- SLOOTWEG, A. F. G., The Netherlands' Marine Cladophora species — Blumea VI, n. 1, 1947—1948, 274—281.
- TAYLOR, W. R., Marine Algae of the Northeastern Coast of North America — University of Michigan studies, Vol. XIII; Norwood, 1937.
- TONI, G. B. DE, Sylloge Algarum omnium hucusque cognitarum; Padua, 1889—1924.
- VELDKAMP, H., The genus Polysiphonia in the Netherlands — Blumea VI, n. 2, 1950, 517—526.
- UJZERMANN, R., Transporteerdend zeewier — De Levende Natuur, 42, 1938, 149—150.

## REVIEW.

**Flora Malesiana**, vol. 4, part 1 — Noordhoff-Kolff, Groningen-Batavia 1948.

It is a pleasant duty to announce a work to which all students of the Malaysian Flora, and I am sure, many others, have been looking forward for some time; the first issue of, it is hoped, a very long and continuous series which will ultimately lead to a complete flora of the Malaysian region, including British Malaya, the Philippines and New Guinea which, floristically speaking, forms a natural unit.

The work, written in English under the auspices of the Royal Botanic Garden Buitenzorg (now Bogor), Java, is the result of the painstaking efforts of its Editor-in-Chief, the well-known Buitenzorg botanist, Dr C. G. G. J. van Steenis. Generously supported by his wife in many respects, he has, and under the most difficult circumstances indefatigably fought to get this extensive project started. Not only he, but the Indonesian Government as well, are to be congratulated on the result of their efforts. It deserves our sincere and warm appreciation that the Government of this young country has understood its responsibilities and is backing the work with considerable interest, both morally and financially.

This is, in the main time, not surprising, since it is a well-known fact that several neighbouring countries are, in this respect, far ahead. The latter statement, however, is neither entirely correct, nor fair. For since about 1920 much material for a flora, both raw and finished, has been collected by the staff of the Buitenzorg Herbarium, and in more recent years Dr van Steenis has been organising a world-wide collaboration; both these circumstances ensure a relatively smooth start of the work, the duration of which may provisionally be estimated at about 25 years.

The first instalment now published comprises, next to the first part of vol. 4, also 'sample treatments' of the Vols 1—3. It is, in this respect, taking the place of a prospectus and it will be sent free of charge to anyone who asks for it on applying to Messrs. Noordhoff-Kolff, Publishers, Groningen (Netherlands) or Batavia (now Djakarta) (Java), or to Dr Fr. Verdoorn, P.O. Box 151, Waltham (Mass.) U.S.A.

The whole work will be arranged as follows. Vols. 1—3, all of about 600 pages of print, will contain the general part and will be published independently from vol. 4 with which the special systematic part starts.

Vol. 1, Cyclopaedia of Malaysian botanical collectors and collections, is in the press. It has been compiled and written by Mrs. M. J. van Steenis, will deal with Pteridophytes and Phanerogams and contain upward of 3000 entries, names of collectors with short biographies, especially regarding their collecting trips, etc., including about 180 portraits. In addition, there are paragraphs on hints for collectors in tropical countries, literature and a subject-index. All this has been very carefully compiled and Mrs. van Steenis has completed a work for which many generations of students of Malaysian Botany will be grateful.

Vol. 2, of which the MS is expected to be completed in 1950, is being written by Dr van Steenis and will deal with "Malaysian Plant Life". It is a much enlarged and augmented edition of the author's 'Maleise Vegetatieschetsen' (cf. review in 'Blumea' II, 2, 1936, 111—115), and will be abundantly illustrated with photographs and maps.

Vol. 3, equally by Dr van Steenis, will be entitled: 'Malaysian Plant Geography'. Part I, which is nearing completion, will extensively deal with the areas of the approximately 2400 genera of Phanerogams; in addition, there will be paragraphs on the history of phytogeographical concepts, the phytogeographical subdivision of the area and the phytogeographical character of the separate islands or island groups. Part II which is still in preparation, will contain the historical plant geography of the region in question and will therefore partly be a continuation of the author's 'Origin of the Malaysian Mountain Flora' (Bull. Jard. bot. Buitenzorg 1934—1936).



With Vol. 4, finally, the flora proper has started. There is a preface by the late director of the Buitenzorg Garden Prof. L. G. M. Baas Becking, an historical introduction, and an interesting paragraph on 'General Considerations', the latter two again by Dr van Steenis. The last-named chapter which is partly published in the first issue, contains a valuable survey of ecological and morphological particulars of Malaysian plants, life forms, etc.

Future instalments of this volume are expected to contain a detailed history of the 'Descriptive Malaysian Botany' by Dr H. C. D. de Wit, instructions for collaborators (which, as a matter of course, have been separately distributed earlier as well) and keys for identification.

As to the systematic part, which will fill the remaining space of Vol. 4 and all of the next volumes, there will be five series, viz.

- I. Phanerogams, about 15 vols.
- II. Pteridophyta, about 3 vols.
- III. Bryophyta, about 5 vols.
- IV. Fungi (incl. Lichenes), about 3 vols.
- V. Algae, about 3 vols.

The entire work is therefore estimated to comprise some 32 volumes. In vol. 4 nr. 1 the following 10 minor families are dealt with according to a concise and standardised method, with adequate illustrations: *Aceraceae*, *Actinidiaceae*, *Ancistrocladaceae*, *Aponogetonaceae*, *Burmanniaceae*, *Nyssaceae*, *Phyllodraceae*, *Sarcospermaceae*, *Sphnocleaceae*, *Stackhousiaceae*. Other families will follow as they are completed.

Our hearty congratulations may be repeated here to Dr van Steenis for his untiring efforts and the remarkable results they have thusfar brought about. We trust that he and his efficient organisation, in which botanists from many countries are involved, will stand any storms of the times to come and that the Indonesian Government will be able to present to the world of botany, forestry, agriculture, horticulture stock-breeding and amateurs, within a reasonable time, a complete and reliable work on the approximately 250 families, 2400 genera and 30,000 species of the area. May it grow to be outstanding in the world of tropical botany and may the editor live to see it completed.

It is expected that every year about 240 pages will be printed, the price being provisionally fixed at Hfl.1.— for every 16 pages. Orders may be sent to Messrs. Noordhoff-Kolff, to Dr Verdoorn (addresses above) or to the Editor-in-Chief, c/o Royal Botanic Garden, Bogor (Buitenzorg) Java, or Rijksherbarium, Leiden; or to any bookseller's.

**Flora Malesiana, Series I, vol. 4, part 2, 1949.**

The second instalment continues and concludes Van Steenis' 'General Considerations', dealing with variations induced by the environment such as life-forms (1st instalment) and genotypic variations (mostly in 2nd instalment). These are a great number (43 in 58 pages with 49 illustrations) of scattered remarks, gathered during a score of years of field work. Many of these paragraphs bear witness of a remarkable sense of observation and many prove to be useful for all students of tropical botany. The second part contains interesting data concerning the distributional types of Malaysian genera, with remarks on speciation, affinities, vicarism, etc.

Follows a 'Short History of the Phytography of Malaysian Vascular Plants' by Dr H. C. D. de Wit. This also is a remarkable piece of work, written in a lively style and based upon a very personal and original views on our botanical ancestors, covering a period of 20 or 30 centuries. It is not a mere compilation from the work of others; it gives (in almost 100 pages) the result of an unbiased study of several sources and it throws a new and interesting light on many outstanding personalities, 96 of which are deemed worthy of a portrait. In addition, several less known investigators are given the attention which was withheld from them thusfar. An index to personal names concludes this valuable contribution.

The instalment concludes with the systematic account of 14 families, viz. *Ceratophyllaceae*, *Hydrocaryaceae*, *Moringaceae*, *Saururaceae*, *Styracaceae*, *Juncaginaceae*, *Trigonaceae*, *Cochlospermaceae*, *Zygophyllaceae*, *Podostemaceae*, *Amaranthaceae*, *Chenopodiaceae*, *Plumbaginaceae*, *Umbelliferae*.

H. J. LAM.





# INHOUD — CONTENTS

	pp.
ADELBERT, A. G. L. — Notes on the Flora of Java, IV . . . . .	310—336
BACKER, C. A. — Notes on the Flora of Java, III. Some remarks on the Moraceae of Java . . . . .	302—309
BACKER, C. A., R. C. BAKHUIZEN VAN DEN BRINK and C. G. G. J. VAN STEENIS — Notes on the Flora of Java, V. Identification of the new species and combinations proposed by C. P. THUNBERG in the Florula Javanica by L. WINDBERG and F. O. WIDMARK, 1825 . . . . .	358—362
BAKHUIZEN VAN DEN BRINK, R. C. — Notes on the Flora of Java, VI . . . . .	363—406
EPLING, C. — Plants collected by TH. HERZOG on his second Bolivian journey, 1910—1911, IX. Labiatae . . . . .	355—357
GOOD, R. — Madagascar and New Caledonia: a problem in plant geography . . . . .	470—479
HAMMEN, L. VAN DER — Traces of ancient dichotomies in Angiosperms. (A contribution to our knowledge of Phyllospory and Stachyospor) . . . . .	290—301
HATTUM, H. J. VAN — Index . . . . .	599—615
JANSSONIUS, H. H. — The variability of the wood-anatomy in large and small genera . . . . .	462—464
—, The vessels in the wood of Javan mangrove trees . . . . .	465—469
—, Wood-Anatomy and relationship . . . . .	407—461
JEUKEN, M. — Revision of the Sapotaceae of the Malaysian area in a wider sense. I. A monograph of the genus Isonandra . . . . .	547—579
KOSTER, J. TH. — Notes on Malay Compositae II . . . . .	264—265
—, Plants collected by TH. HERZOG on his second Bolivian journey, 1910—1911, VIII. Compositae . . . . .	266—273
—, Review . . . . .	597—598
— and H. J. LAM — Review . . . . .	596—597
— and W. R. PHILIPSON — Nomenclatural changes in <i>Spilanthes</i> and <i>Blainvillea</i> with remarks and a key to the species of <i>Spilanthes</i> in the Malay Archipelago . . . . .	349—354
LAM, H. J. — A new system of the Cormophyta . . . . .	282—289
—, Reviews . . . . .	544—545, 596
— and P. VAN ROYEN — Revision of the Sapotaceae of the Malaysian area in a wider sense. II. <i>Burckella</i> Pierre . . . . .	580—593
LUCAS, J. A. W. — The Algae transported on drifting objects and washed ashore on the Netherlands' coast . . . . .	527—543



MAAS GEESTERANUS, R. A. — Revision of the lichens of the Netherlands. I. Parmeliaceae . . . . .	1—199
OOSTSTROOM, S. J. VAN — The Convolvulaceae of Malaysia, VI. The genus <i>Argyreia</i> Lour. in the Philippine Islands . .	337—348
PERDECK, A. C. — Revision of the Lycoperdaceae of the Netherlands . . . . .	480—516
ROYEN, P. VAN — Revision of the Sapotaceae of the Malaysian area in a wider sense. III. <i>Mimusops</i> L. . . . .	594—595
SCHLETTLER, J. — Unsere gegehwaertige Kenntnis ueber die Liliaceengattung <i>Dianella</i> in Malesien . . . . .	200—228
SLOOTWEG, A. F. G. — The Netherlands' marine <i>Cladophora</i> species . . . . .	274—281
STEENIS, C. G. G. J. VAN — Miscellaneous botanical notes. II	243—263
VAROSSIEAU, W. W. — The identification of wood species with the aid of the Hollerith system . . . . .	229—242
VELDKAMP, H. — The genus <i>Polysiphonia</i> in the Netherlands .	517—526

---